PC MAGAZINE

VOLUME 8 NUMBER 8
APRIL 25, 1989

Fine-tune Mouse
Movements with
Free Utility

Mixing Media

How to master the maze of disk sizes, densities, cables, platforms, and file formats

PC Labs Tests
- 7 Laptop-Desktop Linkers
- 6 Easy 3½-inch Drive Upgrades
- 7 Ways to Speak Nine-Track to Mainframes
- 4 Word Processor Format Converters

Plus More Than 30
PC-to-Mac Solutions

- Small and Secure:
PC LAN Labs Tests
12 Diskless LANstations

- 11 Antivirus Programs:
Is the Cure Worse
Than the Disease?

Just a reminder to choose yo

As the PC industry moves rapidly toward graphical environments, you're faced with a crucial decision: To choose the graphical spreadsheet that's emerging as the industry standard. Or to continue

ur next spreadsheet carefully.

trusting a character-based standard that can only take you so far. To help you decide, call for a free, fully functional Working Model of Microsoft® Excel for Windows: (800) 541-1261, Dept. J35. Remember, we're not saying it's an easy decision. Just an inevitable one.

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WHAT'S INSIDE

Though PC programmers and pundits have been talking about computer viruses for years, the phenomenon was first thrust upon the wider American consciousness last September 26 when *Time* magazine featured a shrill though somewhat prophetic cover story on the subject. A few weeks later, 23-year-old Robert Morris, a graduate student at Cornell University, infected the nationwide Internet scientific and defense network with a debilitating but nondestructive homemade virus. Thousands of users panicked, and Pentagon officials were more than a little upset.

Yes, viruses do exist, and they come from some unusual places. One of the strangest of all is Lahore, Pakistan, where the Alvi brothers, coproprietors of Brain Computer Services, infected bootleg copies of popular software with a particularly nasty virus and sold them to unwitting bargain-hunting foreigners over a period of 2 years.

The so-called Pakistani-Brain strain was a little too hot for us to handle, but three other viruses were brought—very carefully—into PC Labs to be used as part of our antivirus software evaluation. PC Labs project leader Pamela Milland was charged with the especially difficult job of creating a testing script that pitted the viruses against the protection programs. As Milland points out, "Viruses don't come with a lot of documentation."

Evaluators of the protection programs were instructed to work behind closed doors in a special section of PC Labs and not to let any unauthorized person in (floppy disks have a way of disappearing when crowds of people walk by). All the virus disks were kept locked in a red box.

A Pandora's box for our time? Project leader Pamela Milland guards dangerous sample viruses.

Of course, all this talk of infection from outside sources shouldn't discourage you from striving to make your PC receptive to as many disk and data formats as possible. This issue's five-part cover story is designed to show you how to outfit your machine to make it more laptop-, PS/2-, mainframe-, and Macintosh-friendly. And we've also tackled the difficult question of word processor format conversion.

For each data transfer problem, there are a number of solutions. The fact that they span the spectrum from $6 cables to $600 software packages to $6,000 networks can make your decisions difficult, but don't be afraid. Every step toward solving incompatibility dilemmas is a step in the right direction.
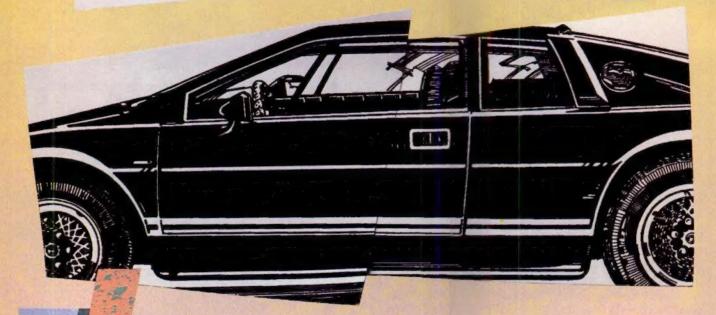—**Donald P. Willmott** PC

Photograph: Thom O'Connor

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PC MAGAZINE

Ticket to Spain: a cultural and linguistic odyssey, After Hours, page 402.

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We are unable to look up past stories, recommend products, or diagnose problems with your PC by phone. If you bought a product advertised in *PC Magazine*, are dissatisfied, and can't resolve the problem, write (do not call) Michael Gratzon, Advertising Department, at One Park Ave. Include *copies* of correspondence.

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THIS IS WHAT HAP
LET OUR CUSTOMERS

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It's the result of a highly sophisticated new design process, never before attempted by any other printer company. We call it "Giving the Customers What They Want."
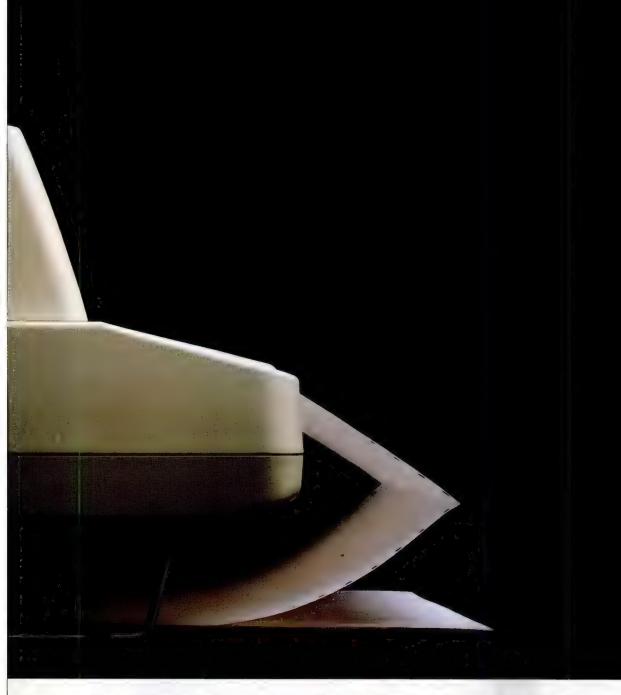
You told us you wanted a

PC Magazine Editor's Choice Award, 10/31/88.

rugged 24-pin printer for under $500. Which the Allegro 24 is. You wanted it to churn out page after page of crisp, letter-quality output. Which it does. And you wanted it with easy-to-use front panel controls. Which, of course, it has.

Then you insisted that it be jam-proof. Which explains this printer's uncharacteristic profile. You see, it has no platen. Just a unique flatbed design for a

PENED WHEN WE DESIGN A PRINTER.

paper path that's straight, direct and virtually unjammable.

As if that weren't enough, you asked for— and got—features like "paper parking," for automatic switching from fan-fold to single sheet feed. Four resident type fonts. And full compatibility with most all the PCs and software you already have.

For a free demonstration of the printer you've always wanted, see your local ALPS dealer. Or direct your questions, comments and brilliant ideas to us at 800-828-ALPS. In California, 800-257-7872.
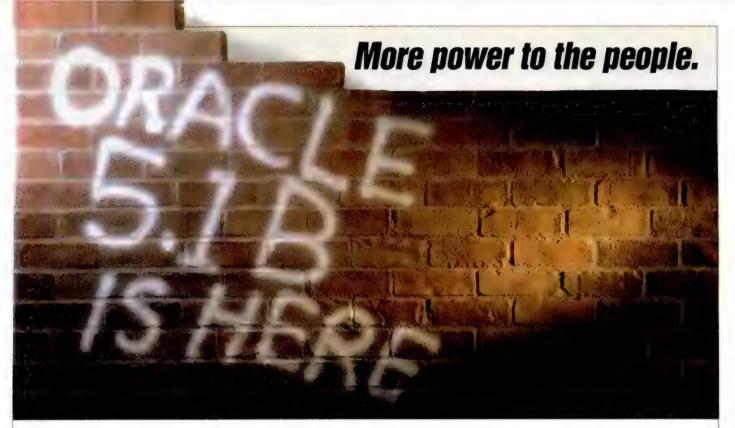
And help us design our next printer.

ALPS
AMERICA

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LETTERS TO PC MAGAZINE

SAY GOODBYE TO IBM

Although I do understand the technical merits of MCA over the old AT-bus and, in some ways, over EISA, I think it's pretty obvious that IBM really doesn't give a hoot about the PC users or the industry at all ("The Great Divide: EISA vs. Micro Channel," *PC Magazine*, December 27, 1988). If IBM wants to turn its back on us, then we can turn our backs on it.

John L. Runnion
Urbana, Illinois

SMART CHOICES?

Stephen Manes's attempt to equate Prodigy subscribers with illiteracy and stupidity leads me to question *PC Magazine*'s policies ("Prodigy: It Don't Get No Better Than This!" *PC Magazine*, February 14, 1989). Will this sort of humor lead to insulting characterizations of users who prefer EGA to VGA or DOS to OS/2?

James E. Borza
Fremont, California

A NIGHT TO REMEMBER

John C. Dvorak's recent blast at IBM ("My Dinner with IBM," *PC Magazine*, January 31, 1989) should tell the discriminating reader much more about Mr. Dvorak's values than it does about any alleged contempt IBM displays for its customers. Mr. Dvorak did not have dinner with "IBM," as his title implies. Rather, he ate dinner with two IBM employees. Nowhere did he indicate that he complained to anyone at IBM about the conduct of these individuals. Instead, he used the incident to engage in what appears to be a favorite pastime of some of your contributors: IBM bashing.

Never mind what really happened that evening (remember, we only have Mr. Dvorak's account); most of us have learned that you cannot extrapolate the actions of a few people to soil the reputation of a whole community.

Ronald L. Mellgren
Sylvania, Ohio

While I enjoy your entire magazine, John C. Dvorak's column is decidedly my favorite section. I thoroughly enjoyed his piece about his dinner with IBM ("My Dinner with IBM").

I have never heard Mr. Dvorak speak, but when I read his copy, the voice in the back of my head is that of John Madden, the football announcer. Dvorak writes like Madden sounds.

Alan Selmanaj
La Habra, California

A note of thanks to John C. Dvorak for his appealing and very amusing article about dining with IBM ("My Dinner with IBM"). I enjoyed every minute of his "fun" with the boys from Big Blue.

Daryl Martin
Reisterstown, Maryland

FOOD FOR THOUGHT

There were a few misconceptions in Jonathan Matzkin's otherwise excellent review of our product, *The Food Processor II* (After Hours, *PC Magazine*, January 31, 1989). Only one beverage is listed because the 130-plus beverages are listed by their real names. Sushi is not ranked as "sushi" because it will vary according to the fish used. When you type in the word TEA, a list of meats will appear as the food search finds all foods with the letters TEA.

Elizabeth Hands
President
ESHA Research
Salem, Oregon

I would like to mention some features that were not included in the review of our product, *The Diet Balancer* (After Hours). A Sort function is available that allows the user to sort through food groups according to nutrients. An additional feature analyzes personal recipes and stores their nutritional contents in the database.

Robert Antonellis
Director
Nutridata Software Corp.
Wappingers Falls, New York

A CHEAP READ

I cannot understand the value of the CD-ROM ("Archives in Miniature," *PC Magazine*, January 31, 1989). Most of the documents on CD-ROMs are available for less money in either book form or from electronic information services.

For example, the mail-order price of *Grolier's Academic American Encyclopedia* is $199. The cost of a CD-ROM player alone is $700, and the price of the encyclopedia on CD-ROM is $400. For this amount of money, you could buy the encyclopedia (complete with pictures) and a good scanner with software.

E. Paul Cone
New Rochelle, New York

■ LETTERS

NICE MICE

I was quite impressed with the layout of the recent mice article (''Tracking the Mouse's Progress,'' *PC Magazine*, February 14, 1989). The section on the E-Mouse and Mitsi Mouse begins on followed by the section on the Omni-mouse and PC Mouse II. The final sentence on page 267 then continues by jumping back to page 264. The section ends on that page and then jumps to page 268 for the next series of reviews.

I guess you didn't use a mouse to lay out the article. It must have been a kangaroo.

Gary Cohen
Highland Park, New Jersey

RUNNING A SLOWER TRACK

We run-of-the-mill people who use DOS 3.1 or earlier and who aren't speed hounds are beginning to feel left out. A large portion of every issue is devoted to OS/2,

> ■ Unfortunately, every business—including magazine publishing— has its share of charlatans and morons, as Mr. Dvorak unwittingly demonstrates.

high-speed computers, and high-priced programs that aren't of any use to us. Many, if not most of us, aren't buying very many programs that cost over $100.

James R. Owen
Bartlesville, Oklahoma

USER FRIENDLY?

John C. Dvorak paints a very gloomy picture of how computer dealers operate. Are business microcomputer systems really sold, supported, and serviced in ''depressing, slimy, heartless, creepy, oppressive, sickening'' places and by ''nerdy and obnoxious geeks and bozos'' (''The End of the Computer Dealer,'' *PC Magazine*, February 14, 1989).

Yes, there are unethical, unprofessional, and ignorant salespeople in the computer industry, but the majority are meticulous in their pursuit of excellence and are eager to share their knowledge with clients. Unfortunately, every business—including publishing—has its share of charlatans and morons, as Mr. Dvorak unwittingly demonstrates.

Semyon Roitman
Entré Computer Center
Princeton, New Jersey

I am in complete agreement with John C. Dvorak's opinion of computer stores (''The End of the Computer Dealer''). It was nice to discover that someone with his level of expertise has had experiences similar to those of a novice such as myself.

Computer store personnel seem to disdain the idea of helping to inform a new user. Thank goodness for magazine software reviews and other sources of information. After buying my system at a computer store, I have purchased virtually everything else via mail order.

Lew Pinsker
Flemington, New Jersey

As fascinated as John C. Dvorak is with the ''computer store phenomenon'' (''The End of the Computer Dealer''), it is obvious that this fascination is not nearly as arresting as his fascination with himself.

There are good computer stores and there are not-so-good computer stores. If computer columnists were computer stores, Mr. Dvorak would represent the latter. He is, as he described, ''cold, heartless, depressing.'' I have ceased to enjoy the experience of shopping for Mr. Dvorak's wit and wisdom.

Thomas J. Woodward
Manchester, Connecticut

■ LETTERS

A BETTER ROUTE

Jim Seymour's remarks about "COBOL guys" who create problems because they view downsizing as a "quick port" are a sure sign of "Dvorakitis": good talk, no thought ("The 'D' Word," *PC Magazine*, January 31, 1989).

Porting may be only the first step in downsizing, but it's certainly not a "dead-end path." It preserves and enhances the application's functionality, while avoiding the career-ending "whole new generation of bugs" that Seymour seems to accept as inevitable.

<div align="right">Robert Power
Stafford, Texas</div>

TRAVELING WITH DVORAK

Three cheers for John C. Dvorak. He just discovered Taiwan ("Hu Is on First?" *PC Magazine*, January 17, 1989). And to

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think that it was only a couple of months ago that he discovered Canada! Someone should get this man a globe. I think the only map Dvorak has ever seen is a weather map.

<div align="right">Victor Berman
Montreal, Quebec
Canada</div>

A TRUE TEST

Your response to Karen Lippe Brown of Iomega Corp. (Letters, *PC Magazine*,

January 31, 1989) makes me question the validity of your benchmark tests. You stated that "the benchmark-test figures . . . reflect that system's performance at its default settings." This was the rationale for testing the Bernoulli Box II with verify on while the other systems were tested with verify off ("Removable Mass Storage: You Can Take It with You," *PC Magazine*, September 13, 1988).

This must be the same mind-set that caused Fastback Plus to test no faster than the DOS Backup/Restore functions in last year's backup software comparisons. I think most of your readers are capable of reading the Bernoulli Box instructions and discovering that they have the choice of verify on or off. Your testing team should be able to do likewise and configure the products identically whenever possible. I think your readers would like to see apple-to-apple product comparisons. I know I would.

<div align="right">Hugh T. Horton
San Diego, California</div>

CORRECTIONS/AMPLIFICATIONS

On pages 242–244 of the Utilities column "ANSI.SYS Without the Hassle" (*PC Magazine*, January 31, 1989), the references to the color parameter 34, which is blue foreground, should be 44, blue background.

An incorrect specification appeared in the review of VIPC Computers Corp.'s VIPC Hybrid ("Good and Fast: Fifteen 386s Push the Performance Standard to 20 MHz," *PC Magazine*, November 29, 1988). The machine has 80-nanosecond DRAM chips installed, rather than the 100-ns. chips cited by the reviewer.

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The 386 Network Manager from Advanced Digital is an extremely powerful and versatile 80386 file server, with all electronics on a single expansion board for easy field repair.

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■ **JOE DESPOSITO**

PC ADVISOR

Advice on choosing a tape drive to service several XT, AT, and 386 computers, and suggestions on filing programs to use with a word processor.

ONE TAPE DRIVE, MANY PCs

I am part of a relatively small company that operates a half dozen IBMs and compatibles, ranging from original PCs to new 386 machines. Most have hard disks ranging from 10 to 40MB.

We would like to back up these machines on a regular basis but find floppy disks too cumbersome. A tape backup system would be ideal, but purchasing six units seems a bit too much. One unit that requires us to open the machines and install cards or cabling would be too much trouble to use with the frequency we would like.

Is there an external tape backup system that can be attached to a serial port and would operate solely through that port with the aid of some software package?

Bill Giuffre
Arlington, Massachusetts

It is customary for file transfer products such as Lap-Link *and* The Brooklyn Bridge *to use the serial port of a PC (see this issue's cover story, "Crossing Format Frontiers: Low-Hassle Solutions to Data Transfer"). Some products even use the parallel port to speed up the rate of transfer. However, products of this type are meant to aid the user in transferring files between computers with incompatible disk drives.*

Tape backup products, on the other hand, usually work off the system's floppy disk drive controller. The problem you have can be readily solved, but not in the way you would like. What you need to do is find a tape drive that can be used with all of the computers that your company owns. Then you must find out how the tape drive connects to each type of computer (PC, AT, or 386). To facilitate frequent backups, you must make each system "tape backup ready." In other words, you must make a one-time installation of whatever hardware is necessary to make a particular system capable of interfacing with a tape backup device. Then you can use a single tape drive to back up all of your computers. You just move the drive from machine to machine.

Micro Design International (6985 University Blvd., Winter Park, FL 32792; (407) 677-8333) markets a product called the MDI External MT-40P/AT, which has a suggested retail price of $595. This product consists of an Alloy APT-40 Model 500 cartridge tape drive packaged with a power supply in a black plastic instrument case with a large handle. Alloy's TIP-40 backup software is also included.

■ **We want to back up our machines on a regular basis. A tape backup system would be ideal, but purchasing six units seems a bit too much.**

If you want to use the unit with an AT or 386 system, Micro Design supplies a cabling system that works off the B: drive output of the existing floppy disk cable in the computer. The cables cost $50 and can be ordered separately so that you can modify several ATs or 386s to share the single tape drive.

If you want to use the tape drive with an IBM PC-XT with one floppy disk drive, an adapter kit is available for $50. If you have two floppy disk drives on the XT, you'll need an adapter board that sells for $90.

Another solution is the Irwin 720SP drive from Irwin Magnetic Systems (2101 Commonwealth Blvd., Ann Arbor, MI 48105; (313) 996-3300), which has a suggested retail price of $649. This drive can be used with all systems, from XTs to 386s. If you use it with an XT, you can use the external floppy disk port of the XT floppy disk controller. If you use the 720SP with ATs or 386s, you'll need to purchase a 4251 interface board ($140) for each computer. One drawback of the 720SP is that it has a limit of 20MB per tape. So to back up a 40MB drive you would have to use two tapes. The drive also runs slower than other Irwin drives that work with AT or 386 computers exclusively. One other feature of the 720SP is that it can be used with IBM PS/2 computers, too, with the addition of an 8451E interface board ($100).

Both of the drives mentioned here are DC2000-type tape drives, which use DC2000 tape cartridges. Reviews and background information on DC2000 tape drives appear in the cover story of the June 23, 1987, issue of PC Magazine.

■ PC ADVISOR

POPPING IDEAS INTO DOCUMENTS
I would like some guidance on software for filing. This may seem simple, but it is frustrating to me. I am a minister (chaplain) and an author. What I'm looking for is a very simple filing program to file away sermon ideas, quotations, and so forth that I can later use in my writing. I've tried some cheap programs and can't get them to work (I am not great with computers—all I do is word processing). When I ask other people for advice, they suggest expensive integrated programs. All I want is a simple user-friendly filing program. Is there any hope?

Chaplain John C. Scott
Woodbridge, Virginia

It seems to me that a good solution to your problem would be a memory-resident filing program. You can continue to use your word processor as your main program, and then any time you want to use an idea or quote stored in your database, you "pop up" the database over your word processor, find the quote, and move it to your current document.

Two memory-resident filing programs to consider are Reference File *from Reference Software (330 Townsend St., #123, San Francisco, CA 94107; (415) 541-0222), which has a suggested retail price of $89, and* Tornado *from Micro Logic (100 2nd St., Hackensack, NJ 07602; (201) 342-6518), which has a suggested retail price of $99.*

Of the two, Reference File *looks more like a standard file manager. That is, you can create a file in the normal way, using field names. However,* Reference File *is actually a "free-form" file manager, which means you do not have to define field lengths.* Reference File *automatically expands the length of the field to accommodate the information.*

Reference File *requires 512K RAM and* a hard disk. A review of the product appeared on page 38 of First Looks in the June 28, 1988, issue of PC Magazine.

Tornado *works in a less structured way. When you enter information, it records the data in a window or Tornado Note. As you write more notes, they fill up your screen. This "pile" of notes can be accessed during word processing by typing Alt-J. A Get command helps you find the note you want.*

Tornado *requires 256K RAM and one floppy disk drive. A full review of* Tornado *appeared in "Classified Intelligence: Managing Personal Information" (PC Magazine, December 13, 1988).*

ASK THE ADVISOR
Send your questions to PC Advisor, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload to PC MagNet (see the Productivity section for access information). Please specify your equipment. 🄿🄲

THIS IS NO PLACE FOR SPACE INVADERS.

A business desk is no place to play games with space. So NEC built three serious machines with one mission in mind: optimum performance in a minimum space. Meet PowerMate® 1, PowerMate 1 Plus and PowerMate SX.

The PowerMate 1 and PowerMate 1 Plus get right down to business. They're industry standard. Powerful. Affordable. Both PCs race through spreadsheets, graphics and hundreds of other general office applications. And with six option slots and memory

expandable to over 10MB, they're ready for the inevitable result of all that tough work. Growth.

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PC MAGAZINE FIRST LOOKS

Adobe Illustrator for Windows: A $695 Shadow of Its Mac Self
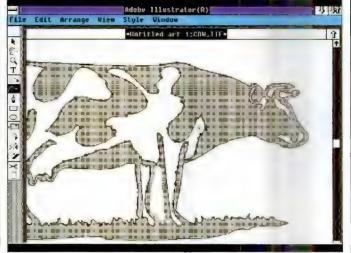
PC HANDS ON

BY ISAAC VICTOR KERLOW

When you boot up *Adobe Illustrator, Windows* Version, for the first time, you might think it's an outstanding program. It allows you to draw and print high-quality PostScript-based outline drawings, is fairly easy to use, and boasts a unique automatic tracing feature that will convert almost any picture in bitmap format into a series of smooth and unbroken curved lines.

But compared with the competition—both *Illustrator*'s

Adobe Illustrator *can automatically trace imported bit-mapped files. Above, the black outline shows the contours traced over the TIFF file.*

Macintosh counterpart and other PC-based drawing packages—*Illustrator* falls short. Adobe Systems left out some of the most important capabilities of the Mac version, giving the PC version for *Microsoft Windows* fewer features than you'd expect for its name and $695 price.

One of *Illustrator*'s major virtues is its ability to translate lines of all kinds into smooth "paths" when printed with a PostScript printer. The program offers three drawing tools: freehand, auto-trace, and pen. Each one of these tools creates line segments defined by anchor

DataEase 4.0 Solves Past Problems, Adds Multiple Tables

PC HANDS ON

BY ALFRED POOR

DataEase is known for its menu-driven interface and the ease with which it can connect information between related database tables. Version 4.0 builds on these historical strengths and launches a serious attack into the middle of the programmable database strongholds.

If you use *DataEase* now, many obvious and welcome changes will strike you the moment you load the upgrade. *DataEase* maintains all related files in a "database," which is a collection of DOS files with re-

lated names. In prior versions, you could identify these databases only via cryptic single-letter names. Now, you can give a full and meaningful name to your system, up to 19 characters long. This means that your "J" database of old now can be renamed "Job Cost Tracking."

In a more significant move, and one that must have caused the folks at *DataEase* much anguish, *DataEase* 4.0 finally brings order to the function-key commands. While past versions used the F4 key as the exit, the new version mercifully assigns exit duties to the Esc key.

The F4 key is not abandoned, however. Since there are many additional function keys

active in this version, the programmers could not conveniently include prompts for them all on-screen at one time. F4 now calls up a line of drop-down menus that make it easy to select from all the available options on any screen.

The improvements to the interface are just one example of the overall enhancements found in *DataEase* 4.0. While earlier versions of the package suffered from potentially serious database size limitations, Version 4.0 allows up to 16,000,000 records in a single file and up to 2,000 files per database. This should be enough for even the largest applications.

HANDS-ON INDEX

Adobe Illustrator

(continued from page 33)

points and direction points. While this system works well once you get used to it, most first-time users will find that drawing lines in terms of anchor points, direction points, and tangents takes a lot of getting used to.

You'll want to use the pen tool for drawing very precise lines. When you can afford a little less precision, however, you'll prefer the freehand tool, which relegates the decision of where anchor points should be positioned to the program. Rectangles and ellipses can also be created with special tools.

The auto-trace tool ranks among *Adobe Illustrator*'s strongest features. This tool allows you to trace around the

shapes or lines of a bit-mapped file automatically. It can also be used for manually tracing selected portions of a shape.

The automatic tracing process always starts with a bitmap image, or "template," captured with a scanner or imported from one of many paint programs. Template file formats include *MacPaint* format (.PNT), Tagged Image File format (.TIF), and *PC Paintbrush* format (.PCX). Once you've imported your template, the auto-trace tool does the rest.

Illustrator's four transformation tools—scale, rotate, reflect, and shear—prove handy for manipulating and duplicating shapes. These functions are easy to use and can be applied to any shape using the mouse or the keyboard. Applying transformation via the keyboard al-

> The auto-trace tool ranks among
> *Adobe Illustrator*'s strongest
> features. This tool allows you to
> trace around the shapes or lines of
> a bit-mapped file automatically.

lows you to specify numerically attributes like degree of rotation and percent scaling.

Another of *Adobe Illustrator*'s strongest features is its automatic conversion of *Auto-CAD* .DXF files into *Adobe Illustrator* PostScript (.AI) or Encapsulated PostScript (.EPS) files. This not only allows you to refine *AutoCAD* drawings, but it also eases the process of imbedding *AutoCAD* drawings into technical reports or documentation, since most layout and pagination programs can import .EPS files.

The file conversion itself takes place in a minute or two, depending on the complexity of the file in question, and it is controlled through simple pulldown menus. The only problem I encountered when using converted *AutoCAD* files was that the program slowed considerably: even selecting and moving objects took several minutes.

Illustrator's most obvious shortcomings lie in the type and color departments. To put it simply, the program lacks color support, period. You'll find no color fills, no on-screen color, no color separation routine, and no support for color PostScript printers. These are features that have been beautifully implemented in lower-priced programs like Digital Research's *GEM Artline*, *Micrografx Designer*, and *Corel Draw*.
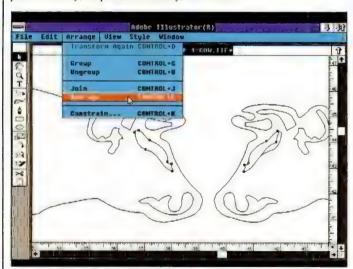
Control over type is also extremely limited. You'll find no special type effects like fill patterns, outlining, and drop-shadows. More importantly for many users, you can manipulate text tracking but not kerning. This means that you can close or open the overall space between all letters in a word or paragraph, but you cannot fine-tune

the spacing between two specific characters without altering the overall letterspacing. This represents a major handicap for users seriously interested in typographic control.

Overall, *Adobe Illustrator*, *Windows* Version, rates as a major disappointment, especially in comparison with its Mac counterpart. While the *Windows* Version is capable of generating high-quality output and boasts a couple of truly wonderful features, namely auto-tracing and *AutoCAD* drawing conversion, its inexplicable omission of color support and certain type-manipulation features make it inappropriate for many uses. PC

Adobe Illustrator *allows nonuniform scaling. The traced cow is shown scaled to 150 percent vertically, 150 percent horizontally, and mirrored.*

The eye at the left shows the effect of Adobe Illustrator's *point averaging. A new point is inserted between the top and bottom points.*

Mace Gold: As Solid as a Tank and as Elegant, Too

BY EDWARD MENDELSON

If Howard Hughes owned a PC, *Mace Gold* would have been his favorite set of hard disk utilities. No other single piece of software knows so many ways to protect a disk and its files from so many different kinds of infection and damage.

Paul Mace Software's $149 utility package tries to protect your disk from disaster by enclosing it in the software equivalent of a combined pharmaceutical warehouse and earthquake-proof bunker. Even if all the preventive medicine contained in the package can't ward off disaster, *Mace Gold* includes a software emergency room that can help restore the disk to something close to its original health.

Mace Gold comprises two dozen utilities and a disaster-recovery manual. The core of the package is a full set of basic disk utilities: backup, cache, defragmenter, directory sorter, nondestructive formatter, and a sector editor that lets you directly alter files, directories, and FATs. All the utilities know how to handle partitions larger than 32MB.

Around this core *Mace* adds a two-level virus-prevention program, two unique programs designed to reconstruct database and word processor files, and a program that periodically saves an image of your computer's memory to disk so you can recover work-in-progress after a power failure. A $99 reduced version of the package, without the backup, memory-saver, and data recovery programs, is sold as *Mace 5*.

Mace's versions of the standard disk utilities tend to have less speed, fewer options, and a more awkward interface than slicker packages like *PC Tools Deluxe* and the *The Norton Utilities*, but they rank among the most trustworthy. The backup program is slow but steady, and it uses separate programs for verifying and restoring the backup. One useful option in the restore program lets

you replace or rename original paths when restoring, so you can easily transfer files from two or more hard disk partitions to one large partition.

Mace pioneered the disaster-recovery technique that saves an image of a disk's FAT and root directory in a special file. *Mace Gold* uses this image file for ordinary undeletes and for major restoration.

Mace's Remedy program is a super-CHKDSK that moves data from doubtful clusters into safe areas and can sometimes recover files on marginal floppy disks. The format program can take a floppy disk that DOS can't read and make it readable through a reformat that preserves existing data.

Mace warns you to save files to disk immediately after using POP to restore them to memory. The manual doesn't add that you should reboot immediately afterward, especially if you use expanded memory. POP can't save the contents of expanded memory, so you're courting disaster if you use POP to reload an application that expects to find data in expanded memory.

Mace's sector editor looks gritty on-screen, but it's the only program of its kind that lets you move directly from the sector you're editing to its entry in the directory or its listing in the FAT and back again. Virtuoso disk surgeons now need only a few keystrokes to make changes and repairs that take a few dozen steps with other programs.

For less confident users, the sector editor can be more of a danger than a help. You use Alt-key combinations to switch from file to FAT to directory, and if your timing isn't perfect, it's all too easy to type a letter into a program file when you think you're giving a command. Later, when the program won't

Mace Gold *includes a powerful, if austere, sector editor. Above, the editor shows the link between one disk cluster and the next as recorded in the FAT.*

run because of the stray character, you won't be able to figure out what went wrong. A function-key interface might take a few milliseconds longer to use, but it would also be a lot safer.

If you insist on working during a thunderstorm or in an area where electric power is intermittent at best, *Mace*'s Power Out Protection (POP) can be a lifesaver. You have to wait while it saves a copy of your computer's memory to disk. But after a power failure, you can use that copy to restart an application with all the data in memory that was there when the program saved it.

Mace's dbFIX and Textfix programs try to reconstruct damaged data files in their original format. With dbFIX you can get back some or all of a scrambled *dBASE* or compatible file. Textfix can recover crucial bits and pieces from *WordStar*, *DisplayWrite*, and *Microsoft Word* files. With other word processor formats you may be able to recover lost text in pure ASCII

format only.

The first section of the manual, "Emergency Help," doesn't rescue data with flashing lights and a blaring siren, but it does tell you how to treat eight different disk disasters. This chapter has more specific details about the dangers of different computers than you'll find anywhere outside of a repair shop. It tells you how to make a Zenith computer boot from a floppy when your hard disk is damaged, and whether or not your clone version of DOS makes recovery impossible. If all else fails, Mace's tech support number appears prominently on the last page.

Should you buy *Mace Gold*? If you're obsessive about defending your data and you work in an environment where viruses and power failures are real threats, *Mace* packs more kinds of protection into one package than anyone else even attempts. But if you're less obsessive, you may not want to burden your disk with layers of memory-resident armor in the form of virus protection and power-failure recovery programs. If the functions you need in *Mace Gold* are in programs you already own, *Mace* probably doesn't offer enough conveniences or speed to make you switch. PC

DataEase

(continued from page 33)

Data-entry-form definition is still easy, and you still name fields with full-length names (which can even include spaces). But field definition now takes place within a pop-up window, and the options are presented more logically and clearly than before. You'll also find a full-screen editor you can call on for entering and editing complex field calculations or custom field-level help messages.

The most exciting aspects of the new form features revolve around the related tables. To start with, you can toggle between a data entry form and a "tabular view," which lists multiple records in a row and column format. You can add, edit, and remove records while using this display. The tabular view can also be used to display records from a related table.

screen form. You can also define a view of a related table as part of a form definition and control the number of records and fields that will appear at one time.

One dividend of this new feature is the solution to a major limitation suffered by prior versions. Since you can create forms that call up the tables as a related view, you are no longer limited to a single data entry form for your data.

The multiple-table features don't end here. The Quick Report facility has been expanded, making it easier than ever to create and modify multiple-file reports. By filling out simple on-screen forms and answering a few clear prompts, you can develop complex reports that would take pages of code with many other programs.

Other form-definition improvements include an easy way to "paint" areas of a form with different display color combina-

DataEase 4.0 supports both custom data-entry forms as well as a scrollable table view, which displays each record on a single line.

tions.

For example, you can display a list of invoices charged to a given account, all from the account screen. You don't even have to do any programming to achieve this impressive effect, and the list can be called on the fly as long as you have established the relationship between the tables, which requires only that you fill out a simple, one-

Should you want to get into programming, *DataEase* 4.0 lets you go further than ever. As in prior versions, its automated query process prompts you through each step of creating simple or complex procedures. You'll find 35 *DataEase* Query Language (DQL) commands, supporting everything from list-

ing records to deleting them. There are IF-THEN and CASE branches, WHILE loops, and the ability to accept keystroke inputs in the middle of a procedure. You can call data entry forms, custom menus, and even standalone DOS programs from within a procedure.

In both procedures and field definitions, you can call on any of 58 functions, including statistical, string, time and date, trig, and financial functions. There are even functions that spell out numbers and dates in full words.

On top of all this, you get full LAN support. The program contains all the facilities for handling file and record locks in multiuser systems, and the exact same applications can be run on either standalone or networked computers. However, you'll need to purchase Workstation Packs to permit multiple workstations to access files, and these cost $750 for use with three workstations, or $1,000 for use with five workstations.
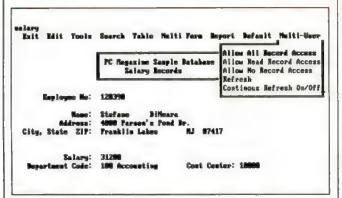
If you like the sound of *DataEase* 4.0 but dread the thought of converting existing database files, cheer up. The program can take your *dBASE*, *Paradox*, *Lotus 1-2-3*, or *Symphony* databases and convert them into *DataEase* forms in a single step. It will even convert *dBASE III* index (.NDX) and screen format (.FMT) files.

One of the few things that has not changed with *DataEase* 4.0 is installation; it is as easy as ever, and the program ships on just three disks.

There is a great deal to like about this latest version. About the only fault I could find is an unfortunate holdover from prior versions. If you have a record on your screen, change some of the information, and then advance to the next record without explicitly saving changes, you lose your edits. It seems unfortunate that the program cannot trap unsaved changes before switching between records.

Overall, *DataEase* appears up to the challenge from the latest and greatest any competitor has to offer. At $700, it offers exceptional value, especially when you consider how quickly you can use it to create and maintain complex applications. **PC**

Should you want to get into programming, *DataEase* 4.0 lets you go further than ever.

DataEase 4.0 now offers drop-down menus in addition to its function-key-command interface. Multiple-user options provide security for LAN installations.

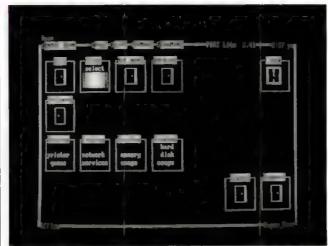# Waterloo Port Lite: A Less-Expensive, Less-Taxing LAN for Small Offices

PC HANDS-ON

BY JOE RIZZO

If you work in a small office, you know how difficult it can be to share information or resources among several people. A network seems the ideal solution to the problem of sharing scanners, printers, or data, but most networks are simply too expensive and complex for a small business.

Enter Waterloo Microsystems' *Waterloo Port Lite*, a low-end entry-level LAN system geared to small offices. The product will compete head-to-head with Novell's own *ELS* (Entry-Level Solution).

Port Lite is a scaled-down version of Waterloo's high-end *Port*. In trimming down the full-scale version, Waterloo concentrated on making the system easier to install, maintain, and

The icons in the Backups "room" show all the possible backup media. You can choose from among five different backup criteria.

administer.

Port Lite allows up to five PCs, connected using ARCnet or IBM's Token-Ring hardware, to form a workgroup. You can set up the system to run one of the PCs as a dedicated server, or you can spread the workload among the workstations in a peer-to-peer arrangement. *Port Lite* can support up to 15 printers, 3 on each workstation (LPT1, LPT2, and

Waterloo Port Lite *lets you use either a DOS- or an icon-based interface. The icons display all the resources and applications available on the network.*

LPT3).

In a small office, the network administrator (if there is one) is usually an employee who must take on the added responsibility of maintaining the network and its resources. Waterloo Microsystems has addressed this problem by creating one small, well-produced manual. Novell's *ELS*, on the other hand, offers eight manuals covering installation and maintenance of its network, plus a ninth manual entitled "Guide to the Manuals."

The *Port Lite* manual comprises 11 short chapters and several appendixes. The manual

guides you through every step of the installation, which is relatively easy to begin with. Once the *Port Lite* operating system has been installed and configured, it is an equally easy process to configure new users and printers and to install DOS applications on the *Port Lite* Network Server System.

Port Lite was also designed with the end user in mind. Like its full-featured sibling, *Port Lite* offers both a DOS interface and an easy-to-use icon-based interface. The icon-based interface gives you visual options for activating applications and sharing resources. It also makes it easier for the network administrator to manage user files, printer queues, and backups.

A backup process has been included in the operating system. One of the icons allows you to enter the Backups room (Waterloo employs a room metaphor for icons and some operations). Once in the room, you have a choice of backing up to a 360K, 1.2MB, 720K, or 1.44MB floppy disk or a tape backup unit. Each time you enter the Backups room, you specify information you want to back up by choosing the appropriate icon. You have five options: back up all DOS files and applications; back up all Network Software Server system files; back up each network
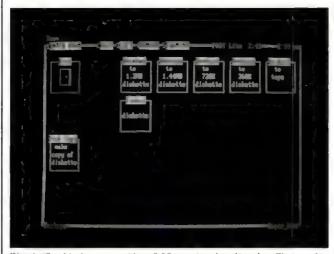
workstation configuration; back up user rooms and passwords; and back up all user files on the NSS.

Waterloo Microsystems will offer *Port Lite* with a maximum of five workstations, five disk drives, 15 printers, and full memory utilization in workstations at a cost of $495. Additional options, including communications, remote workstation access, and e-mail, will be available by the time this issue hits the newsstand.

If you install *Port Lite* now and discover that you need more workstations later, no sweat: you can upgrade to the full-featured *Waterloo Port* system with full credit for *Port Lite*'s $495 list price applied toward the *Port* purchase price.

A comparison with Novell's *ELS* shows that *ELS* supports a maximum of four workstations, five printers, and one shared disk drive for a price of $695. *ELS* does not offer any additional options and cannot be upgraded to Novell's *NetWare*.

If you have a small business but want the sort of workgroup connectivity that large businesses have, *Port Lite* is worth looking into. **PC**

PIPELINE

TOP TEN SELLERS — A 5-Week History

Lotus 1-2-3 2.01
Lotus Development Corp.

Quicken 2.0
Intuit

WordPerfect 5.0
WordPerfect Corp.

The Norton Utilities Advanced Edition 4.5
Peter Norton Computing

5 **Fastback Plus 2.01**
Fifth Generation Systems Inc.

6 **PC Tools Deluxe 5.0**
Central Point Software

7 **Carbon Copy Plus 5.0**
Meridian Technology Inc.

8 **Harvard Graphics 2.12**
Software Publishing Corp.

9 **Sideways 3.2**
Funk Software Inc.

10 **dBASE IV 1.0**
Ashton-Tate Corp.

Lotus 1-2-3 is holding on to the number-one spot among the Top Ten Sellers, but that title is expensive. Lotus is incurring the extra costs of bundling add-on disks with new copies, including a macro-recording utility (in its *Value Pack*) and Funk Software's *Allways* print-enhancement program. It's a classic marketing strategy of spending heavily to protect market share. The only way it works for Lotus is if Release 3 meets the company's expectations of being another best-seller with new users while, at the same time, it inspires most registered users to pay for the upgrade.

The dice will soon be rolled. Early versions of Release 3 were sent to a handful of Lotus's biggest customers in late February for beta testing. The company's still holding to its plan to ship before the end of June.

READING THE CHART

The Top Ten Sellers list ranks PC business programs according to their sales totals in the week ending February 11. The chart that appears to the left of each program's name shows how the program's sales ranked each week for 5 weeks. The hash marks at the bottom of each chart represent each of those 5 weeks, beginning with the week of January 9. Dramatic shifts in a particular program's ranking may be the result of seasonal factors or sales promotions conducted by individual retailers. More than 12,000 individual locations contribute to the list.

Sales information compiled by Ingram Software Inc. and PC Connection Inc.

Rankings are based on net sales by unit; returns are subtracted from gross sales.

PC SURVEY

Tandy's heightened profile for its GRiD line of portables begs the question: How popular are laptops? Very popular, as a recent poll of PC MagNet readers shows. Toshiba still is the clear leader, thanks to its early machines, but Compaq has made major strides. The results shown here for Tandy reflect ownership of the 1400 LT, Models 100 and 200; GRiD's sales are reported separately from Tandy's.

Which of these brands are being used?

Bar chart — Percent axis (0–40+), brands: Toshiba, Zenith, Compaq, NEC, Tandy, GRiD, IBM, Sharp, Dataview, Epson, Mitsubishi, Hewlett-Packard

TANDY SHARING SPOTLIGHT WITH GRiD

In years past, Tandy had a rough time establishing itself as a serious PC manufacturer. Its roots were firmly planted among hobbyists and other fans of low-cost computers, thanks to its TRS-80 and Color Computer. With its 1000 and 3000 series of DOS-compatible PCs, the company succeeded with home users and small offices in the mid-'80s. But its early move into Micro Channel systems and its acquisition of GRiD Systems last year emphasize the importance Tandy places on developing a line that appeals to corporations.

GRiD had an inside track with the kind of buyers Tandy has been courting. GRiD built some of the first DOS-compatible laptops and got it right the first time. It earned a solid-gold reputation with rugged designs and premium performance in the mid-'80s. GRiDs were sold only by an elite corps of salesmen making calls on potential customers. You couldn't walk into a store—Tandy's or anyone else's—and buy a GRiD.

Until now. This spring, Tandy will be remodeling 61 of its Computer Centers as showrooms for the GRiD line. The cables, batteries, and floppy disks will disappear as the emphasis shifts to sleek laptops and GRiD's line of Tandy-manufactured desktop PCs. The Radio Shack name will be replaced by GRiD's on these stores.

The Tandy and GRiD sales teams will also divide territories to avoid competition. Arbitrary rules— for example, GRiD representatives will make sales calls only on companies with more than *x* million dollars of annual revenue—will be put in place for each territory throughout the country. Some companies may find that their Tandy or GRiD representatives will change because of this new policy.

Tandy will keep 300 Computer Centers doing business under the Radio Shack name with a renewed emphasis on small-scale buying needs.

One of the legacies Tandy had to shed in selling its computers to business was the nagging incompatibility with popular software and hardware. Some early Tandy models had nonstandard expansion slots; others had quirky video standards.

That strategy changed. Tandy has aspired to a no-gotcha policy for several years and has largely removed any nonstandard elements in its PCs. Helping remove whatever doubt was left in anyone's mind, it just formalized an agreement with Phoenix Technologies that guarantees Phoenix BIOSs will be used in all Tandy PCs, whether they're classic bus, EISA, or Micro Channel.

It comes at a time when many compatible makers are finding Award's BIOS is superior but, like Tandy, Phoenix aggressively moved into Micro Channel while retaining its reputation for compatibility.

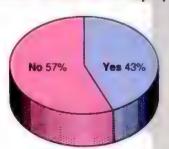### Intel and Weitek Move Ahead with Graphics Processors

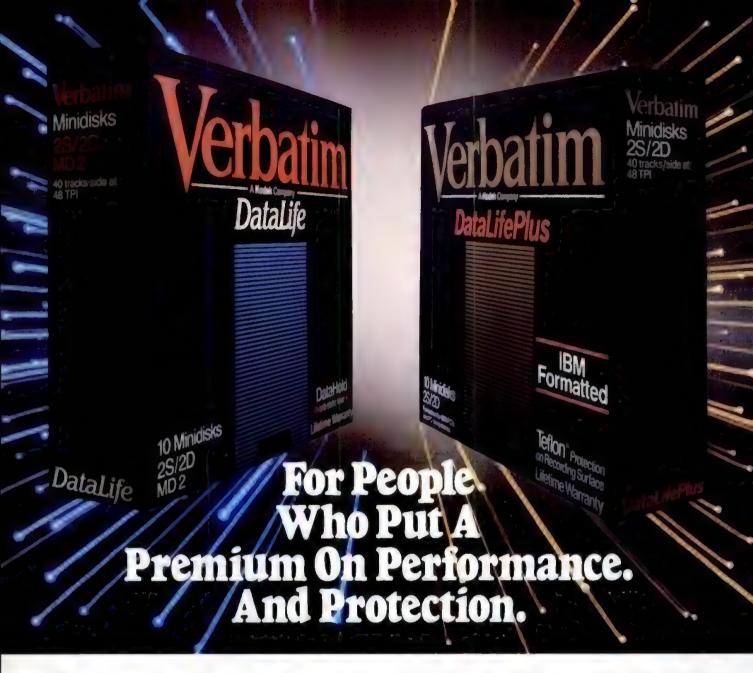The dust hasn't settled around Intel's announcement of its latest wonder chip, the 860, a 64-bit floating-point/graphics coprocessor that's so powerful it could be used as a central processor. PC vendors may incorporate it into 386 PCs (that's how it was originally envisioned) but the most likely use of the expensive 1,000,000 transistor chip appears to be as the heart of a graphic workstation.

The 860 has a RISC design that emphasizes graphic handling. It will cost roughly twice what a 386 costs computer makers.

Weitek, meanwhile, is moving ahead on a couple of fronts. Its 3867 math coprocessor, which first surfaced in Compaq's 386/20 series, is beginning to gather support among software publishers. The newly released PC version of *Mathematica* uses the chip's math-crunching power and an upcoming release of *VersaCAD* will do the same.

Substantial price cuts are expected soon for the 20- and 25-MHz versions of the coprocessor, and a 33-MHz 3167 will be shipping in the spring.

With its math chip on a growth path, Weitek is preparing to launch a PostScript coprocessor. This vector-to-raster processor, the XL 8200, has the potential to reduce the cost of PostScript and PostScript-like printers. Qume is the first manufacturer to give it a try in its liquid crystal, PostScript clone printer called the CrystalPrint.

The chip got a big boost recently when Adobe wrote hooks between the PostScript language and the coprocessor. Adobe is notoriously slow at supporting new devices.

Printer manufacturers that use the chip now will be able to implement genuine PostScript code while using slower (read cheaper) memory and less of it (since the XL8200 has its own memory cache). It won't bring the price of PostScript printers down dramatically but will help bring prices down a bit while increasing performance.
—Gus Venditto

> Printer manufacturers that use Weitek's chip will be able to use slower (read cheaper) memory and less of it.

Does your company plan to buy more laptops?

Those who now use laptops

No 26%

Yes 74%

Those who don't use laptops

No 57%   Yes 43%

For People. Who Put A Premium On Performance. And Protection.

The more invaluable your data is to you, the more you'll value Verbatim.® Because when it comes to high performance and data protection, Verbatim has the winning combination no other floppies can copy.

Consider this: Verbatim DataLife® floppies are engineered to perform an average of 50 million revolutions. That's 15 times the industry standard.

Then consider that Verbatim DataLifePlus™ and DataLife HD 5¼" disks were the first floppies to be factory formatted.

Verbatim also gives you plenty to consider when it comes to data protection. After all, nearly 50% of all computer users have lost time and money due to accidental data loss. That's why Verbatim offers advantages like DataHold™ and DataHold II anti-static liners. So static charges are dispersed before they ever have a chance to build up.

For the world's ultimate data protection, DataLifePlus floppies have an exclusive DuPont Teflon® coating. So fingerprints and spills can be easily wiped from the recording surface.

And of course, all Verbatim floppy disks are tested to be 100% error free and are backed by a lifetime warranty.

Verbatim data cassettes and cartridges, 8", 5¼" and 3½" diskettes. For people who put a premium on performance and protection.

For more information on the full line of high-quality Verbatim products call 1-800-538-8589.

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A Kodak Company

DOING MORE FOR THE DATA PROCESS™

Dolch 25-MHz Lunch-Box Portable

BY JONATHAN MATZKIN

As popular as laptops have gotten, most of them simply don't provide the state-of-the-art performance that the best desktop machines deliver. Even the Compaq SLT/286, amazing as it may be, won't run 386-based software. Nor does it deliver the blinding speed that some applications demand.

For true power users, the best answer in off-site computing remains that hybrid known as the transportable. Dolch Computer Systems' newest entry in this muscle-bound field is

The Dolch P.A.C. 386-25 combines power and portability.

the first 25-MHz 80386 machine you can easily pack up and take away.

The Dolch P.A.C. 386-25 has all the raw CPU power the itinerant number-cruncher could ask for, in basically the same package as Dolch's earlier, 20-MHz machine.

That means that you can install industry-standard add-in cards in the Dolch's expansion bus, making it a good companion to your desktop machine. A fully configured system still has two long slots and one short slot that will accept any add-ins you've already invested in.

The new Dolch also boasts a SCSI hard disk controller and a 64K hardware disk cache.

About the only creature comfort that the system lacks is a hardware RAM cache. That omission becomes obvious when you compare the Dolch's PC Labs benchmark test results with those of cached machines, but the Dolch still solidly outperforms 20-MHz systems.

The Dolch P.A.C. 386-25 is available with a number of memory and screen configurations. If money is no object, you might be tempted to go for the EL (electroluminescent) flat-panel EGA screen that our evaluation unit came with. But the display, while bright and sharp, is also of very limited usefulness. It displays 640 by 350 EGA software only. It won't handle CGA, Hercules, or even other EGA modes.

The EGA screen looked great with *Flight Simulator* and *AutoCAD*, and it might be worth shelling out for if you have specific compatible applications that you want to run. But for most software, stick to the double-scan CGA screen that Dolch offers.

Memory capacity shouldn't be a limiting factor for most applications. The standard configuration comes with 4MB of RAM, expandable to 8MB.

At 20.73 pounds, the Dolch is not fun to carry around, especially in this age of 5-pound laptops. But its main purpose is not field computing; it's ideal for the user who has multiple sites where he wants to sit down and plug in. And since it takes normal add-ins, you can bring your EGA or VGA card along for the ride and plug in an available monitor when you get where you are going.

If the Dolch's weight is a heavy burden to bear, its price definitely is not, at least when compared with units offering similar portability and performance. The basic configuration—with 4MB of RAM, the CGA screen, and the 40MB SCSI drive—carries a retail price of $9,495. In other words, the new Dolch continues the trend started by the company's earlier machine: lots of power for a very reasonable price. **PC**

Benchmark Tests: Dolch P.A.C. 386-25 vs. 20-MHz Compaq Portable 386 and IBM PS/2 Model 70-A21

Currently the only 25-MHz 386 portable on the market, the Dolch P.A.C. 386-25 unsurprisingly outperforms its 20-MHz luggable competition, except for its slow times in the small-record DOS File Access benchmark test. The Dolch's lack of a static RAM cache takes its toll, however, when measuring the machine against the 25-MHz PS/2 Model 70-A21.

The **80386 Instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 80386 instruction code. These instructions are a subset of the total processor instruction set. The 80386 Instruction Mix implements a number of 32-bit operations. In the 80386 processor these become single instructions, whereas in the 8086 and 80286 versions of the benchmark test they remain multiple instructions.

The **Conventional Memory** benchmark test allocates 256K of conventional memory and treats it as a series of 64-byte records. Then, 16,384 random records are read into and written from this memory. The result shown is the average of the read and write times.

The **DOS File Access** benchmark test measures the throughput rate of the disk being tested. In this case, throughput times are measured in terms of how long the disk takes to perform common DOS file-management functions. Five tasks—file creation, sequential file write,

sequential file read, random file write, and random file read—are timed and the results summed.

The test is carried out for two different types of files—small-record files and large-record files—that are used by common PC applications. Files created using

small records are typically used by database management programs, and large records are typically used for word processing and spreadsheet files. Loading a DOS program is also simulated by the large-record test.

Relative Times
(20-MHz Compaq Portable 386 = 100)

Performance Times (Times given in seconds)	80386 Instruction Mix	Conventional Memory	DOS File Access (small record)	DOS File Access (large record)
20-MHz Compaq Portable 386	3.25	0.60	63.93	14.28
Dolch P.A.C. 386-25	2.64	0.55	64.09	7.67
IBM PS/2 Model 70-A21	2.28	0.28	72.37	6.77

Oracle's SQL*Tutor: An Interactive Approach to Mastering SQL Basics

BY RICHARD HALE SHAW

Standard Query Language (SQL) is more than the current vogue in the world of database management systems. It's been a standard on IBM mainframes for several years, and it's gaining popularity with an ever-growing number of mini- and microcomputer DBMSs—most recently *dBASE IV*. Oracle's *SQL*Tutor* is an attractive, easy-to-use, interactive program that can teach you all of the basics of SQL.

*SQL*Tutor* addresses both novices and those who have experience with SQL but need a refresher. The program lets you try out and visually comprehend the result of SQL commands. And, you can run it with as little hardware as a laptop computer in the privacy of your own office or home.

Lesson Plan

*SQL*Tutor* presents a few screens of information at a time, each containing text and graphics that explain the commands you're learning. The program then gauges your comprehension with simple fill-in-the-blank, true/false, and multiple-choice tests.

You get only two tries at fill-in-the-blank questions. The first time you enter an incorrect answer, the program will provide a hint and encourage you to try once more. If you fail on the second attempt, *SQL*Tutor* will step you through a review of the appropriate material. If, after that, you again fail to answer the question correctly, *SQL*Tutor* appropriately considers you to be a hopeless case, displays the correct answer, and moves to the next lesson. You can review material relating to a question at any time by pressing a function key.

If you retake a lesson altogether, *SQL*Tutor* will not test you. I found this helpful, but I thought it would be better to

have a nontest review mode that wouldn't require that you take a lesson with tests first.

The first SQL tutorial section is "*SQL*Tutor* for End-Users," comprising an introduction to SQL, a series of lessons on how to write SQL SELECT statements, and a section on creating queries for reports. Although this introduction provides an excellent overview, it also includes three full screens of Oracle promotional material, which I found annoying and distracting.

In the SQL language section, you'll learn how to build complex queries and order and filter their output. The program will teach you how to use SQL's built-in functions, and you'll discover subqueries and joins. The Report section focuses entirely on output. You'll learn to group rows, generate totals and subtotals, and how to set and substitute column names and report titles.

Don't be deceived by the ominous title of the second tutorial section, "*SQL*Tutor* for Database Administrators." While this set of lessons explains commands that are traditionally the domain of database administrators (DBAs), it is important material for would-be SQL power users. And, novices will find it useful to learn how

SQL's data-manipulation and data-definition commands work. Subsections contained here introduce the concept of data security and how to use and query the system catalogs. You'll also find an excellent lesson on views and a brief discussion of synonyms.

*SQL*Tutor* keeps track of your progress internally as you work your way through the les-


```
ORACLE SQL*Tutor
  Subqueries
    Combining Separate Queries                           18% completed


                          select name, job
       main query         from Employee
                          where job =
                                                    Notice the parentheses
                                                    that enclose the subquery.

                                   (select job
       subquery            from Employee
                                   where name = 'Watson')



                    Just like before, the first step is to find out what
                    kind of job Watson has. This is the subquery, since
                    we need this first to pass along to the main query.



(F1)Reverse   (F2)Menu        Press SPACE to Continue        (Esc)Exit   (F4)Summary
```

*SQL*Tutor* leads you through examples of SQL statements and then tests your comprehension with simple exercises.*

sons—you can jump from lesson to lesson in any order you wish. When you stop, *SQL*Tutor* will save your place in the program. Then, when you run it again, you can opt to resume where you left off or return to the Main Menu.

A prominent feature of *SQL*Tutor*'s menus is a "menu map," a graphic representation of your position in the hierarchy of menus. While this is helpful, it seems superfluous since the menu structure has only three main sections, each running only two to three levels deep. What would be helpful, however, is if the program included a visual checklist of the lessons you've completed.

The program is distributed on three 360K floppy disks. You can copy all but the start-up batch file to a single 720K floppy disk for transport, but you won't be able to run it there: *SQL*Tutor* requires an addi-

tional 4K for each person who uses the course (to save the program location and screen when you exit), pushing its required disk space over 720K. This requirement is too bad, since this is an ideal program to take home on an inexpensive laptop. However, you can run *SQL*Tutor* on a single 1.2MB or 1.44MB floppy disk drive.

The program includes a modest manual that can serve as a fine SQL reference guide. Unlike the program, however, the manual is quite dry and makes one believe that databases are about as interesting as your typical dissertation on macroeconomics. You won't need the manual to run the program.

Complaints

I have a few minor criticisms of this otherwise well-designed and highly useful computer-based learning tool. The program's error messages often seem a bit misleading or vague. When I omitted a column name or misspelled a function name in an SQL statement, the program seemed to think I had messed up all of them. Finally, I didn't appreciate the embedded Oracle advertising and promotional material.

Over all, however, *SQL*Tutor* is lively, fun, and entertaining. You can easily work through the entire course in an evening or two, making it the perfect way to get acquainted or reacquainted with SQL. PC
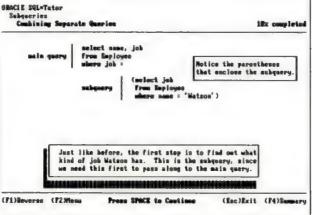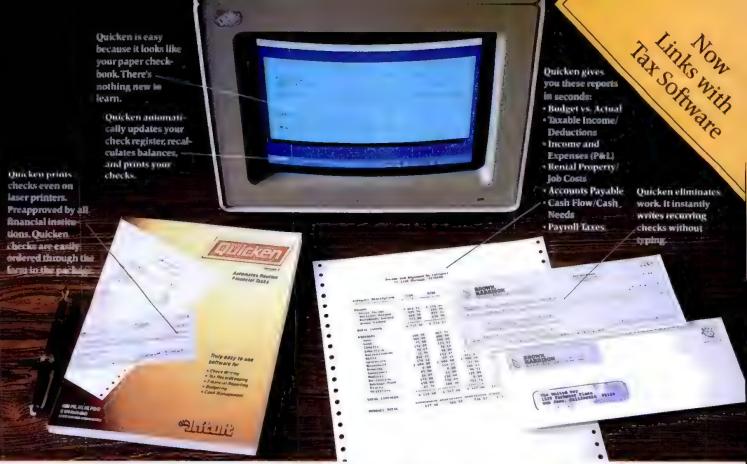
SlideWrite Plus 3.0 Creates Presentation Graphics for Techies, Too

PC HANDS ON

BY MARY KATHLEEN FLYNN

Lotus's *Freelance Plus* and Software Publishing's *Harvard Graphics* have gobbled up huge chunks of the presentation graphics market. With *Slide-Write Plus*, Version 3.0, Advanced Graphics Software hopes to carve out its own slice of the pie. Priced $50 lower and eating up 100K less RAM than the best-sellers, *SlideWrite Plus* 3.0 provides just about everything the presentation-conscious business user needs. And

SlideWrite offers something the more glamorous competition doesn't: a set of features catering to the technical crowd.

By serving two masters equally well, *SlideWrite* is hoping to become the single-standard graphics package for corporations with both business and technical staffs. Users on both sides of the equation will find improvements in Version 3.0.

For splashier presentations, the new version offers a wider array of visual elements. It displays 16 colors in EGA or VGA. Font support has been extended with 16 software and 30 hardware fonts for HP LaserJet

and PostScript printers. (Downloadable fonts are supported, too.) There are now 21 fill patterns, 12 line types, and 7 line sizes. The number of graph series has grown from 8 to 12.
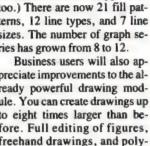
Business users will also appreciate improvements to the already powerful drawing module. You can create drawings up to eight times larger than before. Full editing of figures, freehand drawings, and polygons is extensive. The figure library, which used to be a separate $99 module, is included in *SlideWrite Plus* 3.0—which explains why the new version costs $100 more than the old. You'll find 100 new images in Version 3.0 for a total of 421. The handy point-and-shoot directory makes it easy to pull a figure into a graph.

Another enhancement for the presentation-minded is the batch printing option. It lets you create and display an on-screen slide show. You won't get the special effects of *Freelance Plus* 3.0's Screen Show, but you can navigate through the slides with a keyboard or a mouse, or you can make the timing automatic.

For scientific users, *Slide-Write Plus* 3.0 has equation plotting and has improved its curve fitting and data reporting. The statistics menu selection gives such stats as the mean and standard deviation for any graph you make. To enhance data display, you can choose from five marker sizes and left or right x- or y-error bars.

Importing and exporting capabilities have also been expanded. You can import .TIF, .PCX, and .CGM files and export .CGM, .EPS, HPGL, Lasergraphics Language, and Matrix SCODL files. ASCII and .WK? files are still supported. And, although you can't do a dynamic link to a spreadsheet, as you can with *Freelance Plus* 3.0 and *Harvard Graphics*, you also can't overwrite a worksheet file accidentally.

SlideWrite Plus 3.0 is easy
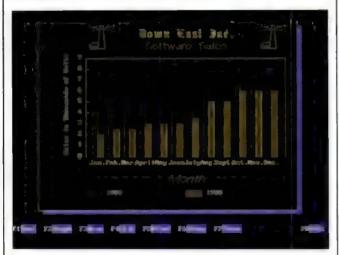
For the scientific graphics user, SlideWrite Plus *3.0 offers curve fitting, equational plotting, error bars, and 19 new chemical process figures.*

For the presentation-conscious business user, SlideWrite Plus *3.0 provides such valuable graphics tools as 16 on-screen colors, 46 fonts, and 421 figures.*

to install—it fits onto three disks—and fairly easy to use. The data and graph options tables allow you to tinker with your graphs easily. The menus are set up logically. They all have prompts, and many have display options.

In vain, I searched for online help—which I was counting on to help me negotiate the drawing commands—but I'm told Advanced Graphics Software prefers menu prompts instead. Luckily, the manual is well organized—a detailed table of contents, indexes, plastic tabs, and go-to references all help you find whatever information you seek.

SlideWrite Plus 3.0 doesn't have anything as fancy as *Freelance Plus* 3.0's device-specific page-preview feature, but if you change your fonts and colors to match your output device, then what you see is basically what you get. The list of supported output devices has grown; some new ones are PostScript and color PostScript, HP LaserJet Series II printers, and Presentation Technologies' Imagemaker Plus and Montage. Printing speed has also been improved.

If you're looking for a graphics package that satisfies the technical needs of scientific users as well as the presentation needs of business users, *Slide-Write Plus* 3.0 has just about everything you want. **PC**

by Lori Grunin

Xerox FormBase Combines Forms Generator, Relational Database
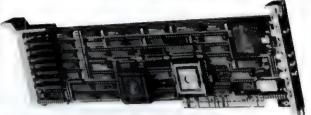
In some forms-generation packages, your data is all dressed up with no place to go; *Xerox FormBase* wants to send it to a relational database.

The $495 forms-processing package, developed by Columbia Software, runs under *Microsoft Windows* and includes its own powerful database. According to Xerox, the package allows you to create complex data-entry and -handling systems simply by defining and linking the appropriate forms; *Xerox FormBase* automatically sets up the corresponding database. Links between forms help eliminate redundant data entry. The software's built-in word

processor uses the same data to perform sophisticated mail-merges.

Xerox FormBase can import and export data from *Microsoft Excel*, *Lotus 1-2-3*, and *dBASE III* and includes drivers for popular printers, including Hewlett-Packard LaserJet and PostScript.

List Price: *Xerox FormBase*, $495 (includes a runtime version of *Microsoft Windows*). **Requires:** 80286-based system, 640K RAM, graphics adapter, DOS 3.1 or later. Not copy protected. Xerox Corp., 101 Continental Blvd., El Segundo, CA 90245; (213) 333-8707.

CIRCLE 437 ON READER SERVICE CARD

character stripping.

The $170 package accepts any ASCII file and translates it into .WK?, .WR?, .WLS, .DBF, .DIF, .PRN, .SYLK, and comma-delimited-ASCII formats. *AutoImport*'s Printer Interceptor utility allows you to capture output for conversion.

After importing the data into

AutoImport, you view the data within a spreadsheetlike interface. You can then, for example, choose which portions to keep and discard, transpose the data, or combine existing files. If you regularly perform conversions on similarly structured data, you can save templates containing all the relevant for-

(continues on next page)

Based on the Hitachi ACRTC processor, the hi-res Artist 12 MC graphics controller comes in 16- and 256-color versions.

PS/2 Controller Provides 1,280 by 1,024 Resolution

If you use a PS/2 and high-resolution, high-performance graphics are crucial to your work, **Control Systems** has a graphics controller for you. The Artist 12 MC uses a Hitachi ACRTC graphics processor to control a noninterlaced display at a resolution of 1,280 by 1,024 pixels.

The controller comes in a 16-color model with 1MB of on-board memory ($3,995) and a 256-color model with 2MB of memory ($5,995). An optional 1MB module ($2,000) will upgrade from 16 colors to 256 colors. Both support single- or dual-screen systems and include display list drivers for use with

AutoCAD, Releases 9 and 10. **List Price:** Artist 12 MC, 16-color version, $3,995; 256-color version, $5,995; 16- to 256-color upgrade module, $2,000. **Requires:** MCA bus machine. Control Systems, 2675 Patton Rd., P.O. Box 64750, St. Paul, MN 55164; (612) 631-7800.

CIRCLE 439 ON READER SERVICE CARD

AutoImport Aids Mainframe-to-Micro File Conversion

Downloading data from a mainframe can be sheer drudgery if the data needs to be reformatted for use in your applications. *AutoImport* from **White Crane Systems** provides relief from tedious rekeying and control-

The First 386 Motherboard for The Compaq Deskpro 8086

HOT PROSPECT

Replacing the motherboard of your 8086-based machine can be the most cost-effective means to satiate an 80386 power craving. Owners of the Compaq Deskpro 8086 can now take the same on-ramp to the fast lane that their PC-clone siblings have been using for years.
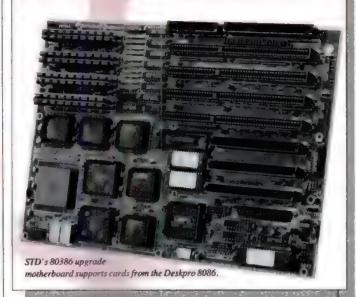
Seattle Telecom & Data's STD-386CP motherboard comes in two versions: a $1,645 16-MHz model and a $2,095 20-MHz model. Both come standard with 1MB of memory, upgradable to a maximum of 16MB. The motherboard has eight expansion slots—three 8-bit, four 16-bit, and one that can be configured as either 8-bit or 32-bit. Number-crunching support takes the form of sockets

for an 8-MHz 80287 coprocessor and a 16- or 20-MHz 80387 coprocessor. You can use all your old cards, such as your drive controller, in the new board.

STD also provides a $29.95 upgrade kit with mounting hardware, cables, and connectors. For the less adventuresome, the company will install, burn-in, and test the board for a fee of $95 plus shipping.

List Price: 16-MHz STD-386CP, $1,645; 20-MHz STD-386CP, $2,095; upgrade kit, $29.95. **Requires:** Compaq Deskpro 8086. Seattle Telecom & Data, 2735 152nd Ave. NE, Redmond, WA 98052; (206) 883-8440.

CIRCLE 436 ON READER SERVICE CARD

STD's 80386 upgrade motherboard supports cards from the Deskpro 8086.

NEW ON THE MARKET

AutoImport

mat information.
List Price: *AutoImport*, $169.95.
Requires: 512K RAM, DOS 2.1 or later. Not copy protected. White Crane Systems, 6889 Peachtree Industrial Blvd., #151, Norcross, GA 30092; (404) 394-3119.

CIRCLE **440** ON READER SERVICE CARD

Switch Routes Fax, Data on a Single Phone Line

The Line One Fax/Voice Switch from **Extel Corp.** lets fax users with a single phone line automatically direct incoming data to the appropriate machine.

When receiving a fax from an automatic fax machine, the $375 switch recognizes the tone and routes the output to your system. The switch differentiates between manually transmitted faxes and voice through touch-tone instructions and voice recognition.
List Price: Line One Fax/Voice Switch, $375. Extel Corp., 3005 MacArthur Blvd., Northbrook, IL 60062; (312) 205-3311.

CIRCLE **442** ON READER SERVICE CARD

*For unattended use,
the Line One Fax/Voice Switch
can work with your answering machine.*

RISC Coprocessor Board Boosts Number-Crunching, Graphics

For those of you who've been yearning to turn your AT into a high-powered graphics or engineering workstation, **Yarc Systems Corp.** offers the AT-Super, a $3,995 RISC-based coprocessor board. The combination of a 50-MHz Am29000 32-bit RISC chip and bus-mastering capability enables the board to provide more graphics and number-crunching power than a Sun 4 workstation does, according to Yarc.

One machine can support up to four AT-Supers, and each comes with 1MB of on-board memory. You can buy the board with 2.5MB of memory for $4,595. Execution speed ranges from 17 to 25 mips (million instructions per second). An optional $950 Am29027 floating-point coprocessor gives you bigger performance boost.
List Price: AT-Super, with 1MB RAM, $3,995; with 2.5MB RAM, $4,595. Am29027 floating-point coprocessor and software, $950.
Requires: 80286- or 80386-based AT compatible. Yarc Systems Corp., 5655 Lindero Canyon, #721, Westlake Village, CA 91362; (818) 889-4388.

CIRCLE **454** ON READER SERVICE CARD

100-Key Remote Keyboard Controls Presentations at a Distance
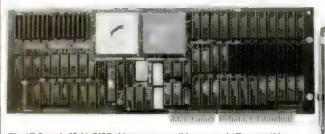
By reducing the footprint of the AT keyboard 60 percent and adding an infrared transmitter, **nView Corp.** hopes to provide solutions to the problems of desktop clutter and remote control of a computer.

The $495 battery-operated nView Toteboard, which will be available in May, has a handgrip for times when you need to stand while you work, and its 11- by 6½-inch footprint minimizes space demands on your desk. Signals are transmitted to the $295 nControl Receiver, which connects to your computer via the serial port, making the receiver compatible with both ISA and MCA machines.
List Price: nView Toteboard, $495; nControl Receiver, $295. nView Corp., 11835 Canon Blvd., Newport News, VA 23606; (804) 873-1354.

CIRCLE **438** ON READER SERVICE CARD

*The nView Toteboard and the nControl
Receiver allow you to control your
computer from anywhere in a room.*

*The AT-Super's 32-bit RISC chip turns your mild-mannered AT compatible
into a high-powered graphics workstation.*

ReadStar EX●PRESS OCR Lets You Fill In the Blanks

When using OCR software that learns new fonts, you typically have to wade through large numbers of unrecognized characters after the document has been processed.

Inovatic's $995 OCR software package, *ReadStar EX●PRESS*, overcomes this problem by allowing the user to interactively identify an unknown character while the document is being scanned. The program will then correctly identify all subsequent occurrences of the character.

ReadStar EX●PRESS also provides intelligent page analysis, which allows it to discern the differences between text, graphics, headlines, and multiple columns. It also recognizes tables, can suppress graphics, and differentiates between portrait and landscape orientations.
List Price: *ReadStar EX●PRESS*, $995. **Requires:** 80286-based system, 640K RAM, DOS 2.0 or later. Copy protected (via parallel port adapter). Inovatic, 1911 N. Fort Myer Dr., #708, Arlington, VA 22209; (703) 522-3053.

CIRCLE **441** ON READER SERVICE CARD

SWAP Shuffles RAM-Hungry TSRs to Hard Disk, EMS

PC HANDS ON

BY EDWARD MENDELSON

DOS's Worst Law: the more useful the TSR, the more memory it takes away from the applications with which you use it.

Microlytics' *GOfer* and Borland's *SideKick* each normally fill more than 60K of DOS memory. Innovative Data Concepts' $20 *SWAP* utilities shrink each one to a mere 9K.

As a bonus, *SWAP* eliminates conflicts between the TSR's hotkey and applications' keystrokes. You can change the *GOfer* hotkey to nonstandard combinations, such as Ctrl-Left Shift-G, that won't get in anything else's way.

SWAP doesn't actually squash *GOfer* or *SideKick* down to size but spirits them off to EMS memory or a disk, shuffling them into DOS memory only when you need them. Unlike such early TSR managers as *Referee*, *SWAP* doesn't need to reserve a large parking lot in DOS, so your applications can use all the RAM that *SWAP* frees.

Also unlike TSR managers, *SWAP* comes in separate versions to partner different TSRs. Right now, you can get $20 models for *GOfer* (SWAPGF) and *SideKick* (SWAPSK). Versions for *SideKick Plus* and *Tornado* are due soon. **PC**

List Price: *SWAPGF, SWAPSK,* $20 each; $35 for both. **Requires:** *GOfer* 1.0 or later, *SideKick* 1.5 or later; 9K free RAM; DOS 2.0 or later. Not copy protected. Innovative Data Concepts, 2084 Woodlawn Ave., Glenside, PA 19038; (800) 242-4775.

CIRCLE **432** ON READER SERVICE CARD

Lotus Worksheets Seen from a Bird's-Eye View

PC HANDS ON

BY CRAIG STINSON

If you create sprawling worksheets with widely separated functional areas, you may find Intex Solutions' *Panorama for 1-2-3* a very handy addition to your spreadsheet toolbox.
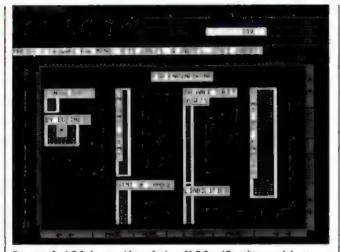
This *Lotus 1-2-3/Symphony* add-in provides an "aerial" view of your Lotus landscape, showing nonblank cells as tiny rectangles and spelling out the full names of ranges. You can choose from seven different viewing angles—the widest of which shows 111 rows by 256 columns.

Panorama also makes navigation easier; you can use either a keyboard or a mouse to jump directly to any spot on the worksheet. As you move about, a miniwindow shows the full contents of the nine cells directly under *Panorama*'s cursor.

While viewing your worksheet from on high, you can take advantage of several editing features, including search-and-replace and such named-range functions as Create, Delete, Copy, Move, and Erase. You can insert or delete rows or columns, change column widths, and specify a new print range.

Two particularly handy features (both missing in plain-vanilla *1-2-3*) are the ability to copy column widths along with data and an Undo command for error reversal.

Panorama's main virtue, though, is that it can help you map out a large spreadsheet. If it saves you an hour or two unraveling someone's spaghetti modeling, it may well be worth its substantial price. Until April 30, it's priced at $95. Afterwards, it'll run you $145. **PC**

List Price: *Panorama for 1-2-3,* $95 until April 30; $145 afterwards. **Requires:** *Lotus 1-2-3,* Release 2, or *Symphony;* graphics display; 52K RAM (*1-2-3*), 58K RAM (*Symphony*); DOS 2.0 or later. Not copy protected. Intex Solutions Inc., 161 Highland Ave., Needham, MA 02194; (617) 449-6222.

Panorama for 1-2-3 *shows a wide-angle view of* 1-2-3 *and* Symphony *worksheets.*

CIRCLE **433** ON READER SERVICE CARD

Ready-Made Macros for Lotus 1-2-3

PC HANDS ON

BY ROBERT L. HUMMEL

Individual Software's *101 Macros Plus for Lotus 1-2-3* crams onto a pair of disks a valuable collection of macros that enhances any spreadsheet created with *Lotus 1-2-3* or with a *1-2-3* work-alike. The simplest of these macros let you use single-keystroke specials to correct common mistakes; the more complicated ones program complex, interactive spreadsheets.

The macros are grouped according to function, so you can locate the ones you need easily. Among the categories included are database operations, data manipulation, file management, printing, and copying.

Although you don't have to be a *1-2-3* guru to use this product, you do have to know about directories, ranges, and basic spreadsheet operation—you won't find a *1-2-3* tutorial here. But you won't have to know anything about macros, because using the ones in this collection couldn't be easier.

First, copy a macro into a blank area of your spreadsheet with *1-2-3*'s /File Combine instruction. Then, give the macro a name using the /Range Name Labels Right command. After that, you're a single keystroke away from putting your new macro to work. And because all the instructions are visible, the package makes a great study guide for aspiring macro programmers.
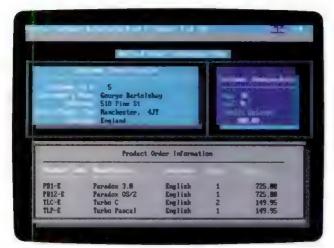
I counted a generous 117 macros. A few are trivial; others proved indispensable; and two (a pop-up calculator and a simple word processor) were impressive achievements. You won't use them all, but you're sure to find one or more that justifies the $69.95 price. **PC**

List Price: *101 Macros Plus for Lotus 1-2-3,* $69.95.

Requires: *Lotus 1-2-3,* Release 1A or later, or *1-2-3* work-alike; 8K free RAM; DOS 2.0 or later. Not copy protected. Individual Software Inc., 125 Shoreway Rd., #3000, San Carlos, CA 94070-2704; (800) 331-3313, (415) 595-8855.

CIRCLE **431** ON READER SERVICE CARD

$90 PC-File:dB Reads, Writes dBASE Files
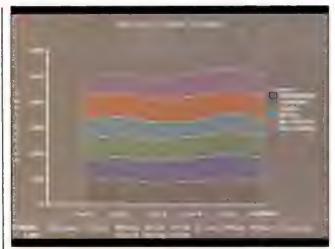
BY RICHARD HALE SHAW

High-end database management programs have a habit of turning the simplest of tasks into a major project. They make it difficult to generate a simple database report or require you to learn cryptic commands just to create mailing labels. And if you're thinking of graphing your data, forget it: the high-end database packages are just getting around to this one.

PC-File:dB, a $90 shareware package from Button-Ware, greatly simplifies these tasks. The shrink-wrapped package includes two disks, a Beginner's Manual, and a User's Manual, and it is just a little larger than a video cassette. Don't be deceived by its size or price, however: inside is a DBMS that can make short order of elaborate output.

The latest incarnation of ButtonWare's well-established

PC-File:dB *lets you graph your data with only a few keystrokes. You can change graph colors and graph type on the fly via a menu at the bottom of the screen.*

Beginner's Manual not only leads you through the quick installation but also includes a discussion of database terminology, with instructions for creating, modifying, searching, and sorting a database.

The program itself is menu driven and easy to use. You'll

You can search PC-File:dB *databases by field value or record location or by using the Browse facility. As shown above, the program supports VGA text modes.*

PC-File (see "Flat-File Databases: Easy-to-Use Sophisticates," *PC Magazine*, April 12, 1988), *PC-File:dB* also boasts file compatibility with *dBASE III Plus*. The package includes a program for converting files generated with previous versions of *PC-File*.

You can be up and running with *PC-File:dB* in a snap. The

find the more-mundane maintenance functions on a separate Utilities menu. You can configure the program environment (colors, printer defaults, and so forth) at any time and save the configuration.

The Browse/Edit facility in *PC-File:dB* is as easy to use and nearly as powerful as the one in *dBASE IV*. You switch between

browsing a database and editing records with one keystroke.

What many users will find to be *PC-File:dB*'s greatest strength is its ability to produce instant reports, labels, customized form letters, and instant graphs. The formats for several of these are provided, and I was able to generate reports and graphs within a few minutes of running the program for the first time. With *PC-File:dB*, you can quickly create excellent graphics images from database data. And, you can switch among bar, pie, line, and scatter graphs instantaneously.

Context-sensitive on-line help pops up in a window when you press Alt-H. It not only gives you immediate assistance, but provides you with the associated page numbers from the User's Manual.
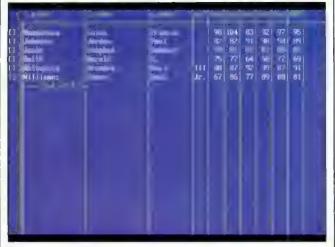
Although the documentation claims no file compatibility with *dBASE IV*, I had no problems using a *dBASE IV* file with *PC-File:dB*. In its present form, however, *PC-File:dB* will not create *dBASE IV*'s new multiple-index files. So, you can use a *dBASE IV* database with *PC-File:dB*, but you'll have to reindex the file with *dBASE IV* if you are going to use it with that database manager, too.

PC-File:dB allows up to 1 billion records per database, with a record length of up to 4,000 characters. You can have

as many as 70 fields per database, including multiple memo fields, which can comprise up to 5,000 characters. The package allows up to 10 indexes per database, so searches are fast. Network support includes automatic record locking.

A typical first reaction to this database might be "It's great for a one-computer office or for end users who don't know how to use *dBASE*." But you can use *PC-File:dB* when you don't have a menu-driven *dBASE* application or when someone needs to run reports and labels from a single *dBASE* database file. Why buy another copy of *dBASE* when you can pick up *PC-File:dB* for under $100? And, since *PC-File:dB* is shareware, you can try out a bulletin board copy before you purchase one from ButtonWare.

There's no question about it: *PC-File:dB* is more than cute. Its size, cost, and packaging belie its actual power. Whether you're looking for a low-cost *dBASE* substitute or a package that's powerful in its own right, give it a try. **PC**

PC UPDATE

askSam 4N Runs Under Network

askSam, the text-based information manager, is now available in a network version. *askSam 4N* allows multiple and simultaneous questions to be asked of a file. *askSam 4N* retails for $895 for up to ten terminals. Each additional set of ten terminals is $500. askSam Systems, Perry, Fla.; (800) 327-5726.

SEAdog Offers Script Language

System Enhancement Associates is now shipping a new version of *SEAdog*, its store-and-forward electronic-mail program. Version 4.5 provides real-time conferences, script lan-

SEAdog offers editing abilities in a full-screen mode.

guage, off-line text editor and full-screen editor, and remote access of computers. Upgrades are available for $50 per station if the original master disk is included. New packages retail for $99.95 per station. System Enhancement Associates, Wayne, N.J.; (201) 473-5153.

PCX Programmer's ToolKit Extends VGA Support

PCX Programmer's ToolKit, from Genus, has added support for extended VGA modes capable of displaying a resolution of 800 by 600 pixels in 26 colors. Version 3.0 also provides enhanced compiler support and virtual memory buffers. Upgrades are available for $35, new packages retail for $125, and source code is an additional $125. Genus Microprogramming Inc., Houston, Tex.; (713) 771-4914.

Macola Redesigns Screen Displays

Macola Accounting Software now supports Novell's Transaction Tracking System (TTS). Version 3.13 has also added search windows, report screens, and paging features. Capabilities that were originally offered at extra cost are now included in the standard program. Each accounting, distributing, and manufacturing module retails for $795. Inventory Management, Customer Order Processing, Purchase Order and Receiving, and Bill of Material Processor retail for $895 each. Material Requirements Planning, Master Scheduling, Job Costing, and Shop Floor Control are $1,595 each. Macola Inc., Marion, Ohio; (614) 382-5999.

PC-Type II Adds Multiple Windowing

ButtonWare's *PC-Type II* word processor has a 100,000-word spell-checking dictionary and the ability to split screens horizontally and vertically in up to four windows for a maximum of ten simultaneously open files. The upgrade offers access to ButtonWare's database products—*PC-File:dB*, *PC-File Plus*, and *PC-Calc Plus*—and ASCII-formatted data. The program retails for $89.95. ButtonWare, Bellevue, Wash.; (206) 454-0479.

Concurrent DOS 386 Enhances Connectivity

Concurrent DOS 386, Version 3.0, increases available memory for running applications and provides improved idle detection. Updates are free to those who registered after December 6, 1988; all other updates are $95. The System Builder's Kit can be upgraded for $135. The three-user version costs $395, and a ten-user version is $495. Digital Research, Monterey, Calif.; (408) 649-3896.

DesignVision Simplifies Diagramming

Optima has created an entry-level version of its *DesignVision Computer-Aided Software Engineering (CASE)* tool. *DesignVision ELS* uses the same interface and graphics but includes predefined models for ten diagramming methods, which can be individually customized. *DesignVision ELS* retails for $995. Optima Inc., Schaumberg, Ill.; (312) 240-1888.

QuickPak Supports LIM

QuickPak Professional Library, from Crescent Software, now provides full support for LIM expanded memory. Version 2.0 also features a string manager to override the 64K size limit and a simplified method for handling

QuickPak provides new menu and editing features.

DOS errors. *QuickPak* includes additional string and math functions, more mouse and menu routines, and a new library manager. Upgrades from the original *QuickPak* are available for $119 and from the earlier version of *QuickPak Professional* for $49. New packages retail for $149. Crescent Software, Stamford, Conn.; (203) 846-2500.

WHEN A HARD
YOU ONLY HAVE
DISCARD.

DISK IS FULL, TWO CHOICES.

OR HARDCARD.

When most people upgrade their hard disks, it's two steps forward and one step back. First, they download all their files onto floppy disks. Then they throw out the perfectly good old hard drive, and put in a new one with more capacity. Then they fill it halfway full of the old files again.

But instead of wasting all that time and money, you can add Hardcard.® It's a hard disk on a 1" wide card, so it fits into any single expansion slot of your 286 machine. Which means you can keep your old 20 or 40 Mb drive right where it is. And still add 40* Mb of brand new capacity, for a total of 60 to 80 Mb.

And this has to be the most convenient upgrade you've ever seen. Just plug Hardcard 40 into a 16-bit slot, and that's it. You don't

have to transfer files onto floppy disks, then reload them onto the new drive. Or waste anyone's valuable working time.

Of course, you get real performance, too. Hardcard gives you 28ms effective access time. And 60,000 hours MTBF, which is three times more reliable than most other drives. And now, you even get all this along with a two-year warranty.

When you have to upgrade a full hard disk in your 286 PC, don't discard it. Do what over half a million satisfied users already have done. Hardcard it. Call your dealer for more information, or 1-800-826-8022.**

Plus

LAN vendors camp out

SUDDENLY THE DOOR SWUNG OPEN AND THERE STOOD JOHN DVORAK WITH A NOTE PAD PENCIL AND A TWISTED GRIN ON HIS FACE

es. The command shows how many hidden files are
rd disk, but doesn't tell you the file names or their l
pe "Chkdsk \VI more" to see a list of all the files
rd disk, including the hidden ones, directory by di:
u can find the hidden files by comparing a printout
es with the listing from the "Chkdsk \VI more" con
If you do need to store old files on your hard disk, c
rtitioning the disk into two logical drives and dedica
the drives to archived files. The benefit to this app:

If this handy tip from "Five Steps to Taming a Wild Hard Disk" in Personal Computing (January 1989) doesn't work, you might try typing "CHKDSK /V| MORE" instead. Other tips from the article: (1) "make backups," (2) "delete files you don't need." Now you're a power user.

Lotus improves Excel

Inside, the Excel benefits

LOTUS HAS PRODUCED   cosmetic changes and   the late Colin Chapman's

Headline in Britain's Autocar & Motor magazine, October 5, 1988, announcing new versions of the Esprit and Excel, by the British car maker.

In 1978, the development of an accessory called a modem (modulation-demodulation device)—pioneered by Dennis Glayes of Glayes Microcomputer Products, Inc.—allowed personal computers to use telephone lines to exchange information and to tap into mainframe computer data bases. This opened a wealth of information to pc users and helped legitimize the practicality of the n

"The IBM PC truly legitimized the personal computer in business, and *Blue Magic* tells the story of this most important product . . . and more importantly, the triumphs and sorrow of all the key people involved."
—Dennis Hayes
Founder, President
Hayes Microcomputer Products

A special sorrow: Poor Dennis Hayes. He provides an advance, back-cover plug for Blue Magic (Facts on File Publications, $19.95), James Chposky and Ted Leonsis's book on the origins of the IBM PC, and on page 7, Hayes's name and company name are misspelled.

It's News to AT&T

"The [Arpanet] virus was known to have infected computers at Harvard, Boston University, Stanford University, University of California at Berkeley (where the UNIX operating system was developed), the Lawrence Livermore Laboratory, NASA Ames Research Center, ..."
—Tech Talk, *MIT weekly newspaper, November 9, 1988*

Help Wanted (M/F)

"ElJay Division of Cedarapids, Inc., a heavy equipment manufacturer, has an immediate opening for a Computer Programmer/Systems Support Specialist . . . .Our computing environment includes a network of over 125 terminals & personal computers tied to a DEC VAXcluster. Applications include MRP II, CAD/CAM, Electronic Male and Computer Integrated Manufacturing."
—The Sunday (Portland) Oregonian, *November 6, 1988*

Have you seen anything offbeat, unusual, or plain dumb about the computer industry? If so, send your submissions to Communiqués, PC Magazine, One Park Avenue, New York, NY 10016. Please print your name legibly; include the name, city, and publication date of any newspaper or magazine clipping, and include your T-shirt size. Contributors will receive $50 and a PC Magazine T-shirt. Sorry, but any unused entries cannot be acknowledged. In case of duplicate entries, the earliest postmark will prevail.
Winners for this issue: Sammy Chan (CHKDSK VI), Julius Chang (UNIX rebirth), Kirk Fraser (electronic male), Gul Murjani (Lotus Improves Excel).
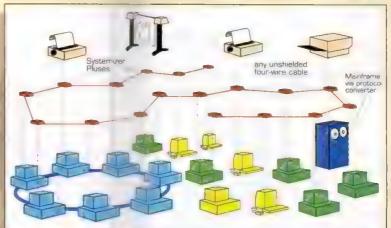
Illustration: Richard Tennant

Who Says FoxBASE+ is Better than dBASE®?

FoxBASE+/386 · **FoxBASE+** · **FoxBASE+/LAN** · **FoxBASE+/Mac**

The Experts!

The Best Just Got Better—Now Shipping New FoxBASE+ Version 2.10!

Nicholas Petreley, *InfoWorld Review Board:*
"FoxBASE+ has outdone itself. Once again, FoxBASE+ earns an "excellent" in performance, with kudos for responding to user suggestions. For sheer productivity, there is no other choice." *InfoWorld* "Editor's Choice" for 1987 and 1988!

P.L. Olympia, *Founder & President, National Dbase Users Group / Government Computer News:*
"FoxBASE+ is a supercharged dBASE, with all the features Ashton-Tate forgot. If you're into serious dBASE development and have not tried FoxBASE+, you are living in the dark ages and wasting your company's money."

George F. Goley IV, *Cont. Editor, Data Based Advisor:*
"The product is fast, very compatible, fast, easy to use, fast, relatively inexpensive, and very fast. In every test, FoxBASE+ outperformed the other products. And people who answer the phone at Fox know what they are talking about."

David Irwin, *Former President/CEO, Data Based Advisor:*
"From the dBASE compatibility standpoint, FoxBASE+ is flawless. From the speed standpoint, FoxBASE+ is unbelievable. From the "lazy factor" standpoint, FoxBASE+ is perfect."

Glenn Hart, *Contributing Editor, PC Magazine:*
"Initial tests of FoxBASE+ were simply stunning. In many ways, FoxBASE+ gives you the best of both worlds: all the benefits of interactive development and debugging, plus the speed and code protection of a compiler."

Adam Green, *Contributing Editor, Data Based Advisor, dBASE Author:*
"For the PC, FoxBASE+ has consistently set the performance standard for dBASE compatible languages. For the Macintosh, FoxBASE+/Mac will set standards for innovation and leadership in a new dBASE implementation."

Don Crabb, *Contributing Editor, InfoWorld:*
"You can expect blazing speed on the Mac. FoxBASE+/Mac breezes past tests that have proven stumbling blocks for Macintosh databases in the past. FoxBASE+/Mac combines complete dBASE compatibility with a genuine Macintosh user interface."

This is what they said about Version 2.00 of FoxBASE+. Imagine what The Experts will say about New Version 2.10 with these added features: Menu-Driven Interface, Program Documentor, Screen Painter and Template-Based Application Generator . . . and Version 2.10 is even faster than 2.00!

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CIRCLE 112 ON READER SERVICE CARD

■ BILL MACHRONE

CAN LANS REPLACE MINIS?

PC-based LANs have finally caught up to minicomputers in the file-sharing arena. The next scrimmage will be fought over database and accounting turf.

One of the things we do best at *PC Magazine* is cover a single subject in depth. Four times a year, we publish a "blockbuster" issue, in which we devote the entire features section to a single subject. At the moment, we're gearing up for our September 26 blockbuster on local area networks. You can help guide our coverage by supplying your opinions on what makes LANs so terrific.

For the last 3 years, I've spoken at the Army Corps of Engineers' annual symposium for its data-processing and personal-computer support people. Each year, the same attendee has asked me the same question: Can LAN-based PCs replace a minicomputer? He was specifically interested in LAN capabilities for database applications, which require multiple, simultaneous access to files, as well as updating, transaction logging, and backup.
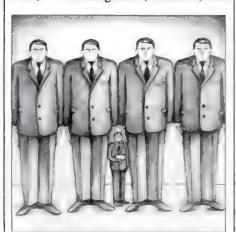
Three Years Ago The first time he asked, I answered, "Definitely not." At that point, minicomputer operating systems and databases were infinitely superior to PCs in maturity, richness of features, data integrity, and data security. Which is not to say that LANs weren't useful in 1986. Light file- and document-sharing among small numbers of users and electronic mail were about as far as anyone cared to push them, though.

Two Years Ago The next time, my answer was a qualified no. LAN applications had gotten much better. LAN operating systems were maturing. Third-party vendors were offering network management utilities that elevated the convenience of LAN use to new heights.

One Year Ago Last year, things really began to change. And I changed my answer to a qualified yes. All of the leading database products, except for *dBASE III*, had new versions with specific, powerful LAN support. Operating systems from Novell and 3Com had improved dramatically and were well supported by convenient, powerful system utilities. The year of the LAN had finally arrived.

This Year If I'm asked this question again, my answer will be an unqualified, enthusiastic yes. LAN software has evolved to the point where you can build networks that are about as large and capable as you like. And that's what our special issue will be about: software that is better because it's made for a LAN.

YOU CAN HELP If you're already into LANs, I'd like to hear what helps you get the most from workgroup, electronic-mail, LAN-management, database, and

accounting software. If you're not yet up and running on a LAN but are headed that way, I'd like to know your short list of concerns and obstacles. That way, we can tailor this issue to your needs. I'd also like to invite you to help us unearth the few truly exceptional products that make LANs worth having. We may not have heard of all of them and would appreciate your opinion. Here's what we're looking for:

In groupware, we're going to explore the LAN's impact on group productivity. Some groupware is nothing more than an elaborate straitjacket. We want to examine software that provides tools and solutions, not a canned methodology that may or may not fit the way people work. My list of groupware features that work *for* the user includes calendaring, scheduling, collaborative conferencing, file attaching and transmitting, and annotating.

Electronic mail is closely allied to groupware. But it has enough tricks up its sleeve to constitute a separate category.

Here at *PC Magazine*, we're e-mail junkies—even though we're not extensively networked yet. We use MCI Mail as our wide-area network. Work-crazed yuppies that we are, many of us continue our discourse on magazine issues, plans, meetings, products we've seen, and plain old fun while sitting at our home machines and portables. So any e-mail package worth its salt should be able to transfer binary files—be they spreadsheets, short programs, screen captures, or whatever. And it should dispense with long formal names. If I had to type \PCMAG \LABS\ADMIN\JOHND every time

■ BILL MACHRONE

I wanted to send a message to PC Labs director John Dickinson, I'd go nuts.

LAN e-mail has to be cognizant of the outside world, too. If I've established bridges to other LANs, internal or external, I shouldn't have to go through a lot of torment to reach people. And I shouldn't have to care if some of my correspondents are available only through MCI Mail or one of the other public carriers. I might need an additional bridge product, but I don't want any differentiation between the way I correspond around the corner with executive editor Bill Howard or across the country with contributing editor John Dvorak. And I need to be able to dial in and use the network's e-mail from anywhere.

MINI SHOWDOWN Databases and accounting will be the battlefields for the war between LANs and minicomputers. Both applications need multiple, simultaneous access to files. Now that server-based applications dot the horizon and SQL has become the lingua franca among database products, PCs offer file-sharing capabilities just as robust as any other computing platform. Such sterling products as *Paradox OS/2* harness the latent powers of the LAN, letting you distribute your processing over the entire network.

While database products are tool kits and raw materials, accounting packages are finished goods, tailored for a single function. But the specialization of accounting doesn't weaken its impact on the computing world. Let's not forget that accounting was the first application to bring computers into the business world. It's the application that upset IBM's earliest market forecast; it's the one that proved there was room in the world for 40 or maybe 50 mainframes. Accounting was the cornerstone of the mini's invasion of small- and medium-sized businesses. It's the table from which the LAN-based PC will take the minicomputer's bread and butter.

Operator-level transaction logs, rollback, selective backup and restoration, and audit trails are just the basics for playing the accounting game. We're looking to PCs for exceptional features: interactive real-time update, real-time application of transactions across all modules, and import and export to other PC-based tools.

That's my opinion. What's yours? **PC**

"At 20MHz this is the fastest
beast I've ever
had the pleasure to meet."

John C. Dvorak
Columnist, PC Magazine

IBM PS/2 Model 80 (20 MHz)	_____	3.52 MIPS
Compaq DeskPro 386/20	_____	4.59 MIPS
Everex Step 386/20	_____	4.91 MIPS

Power Meter MIPS Version 1.2. The Database Group.

"What am I doing
here?"

I guess I have a
reputation for
saying what's on my
mind. So when
the people at Everex
asked me to be in
their ad, I said it was
okay as long as they
let me have the floor.

The reason I like
their Step 386/20 is
simple. It's fast.
It is definitely the
fastest machine
that I've seen so far.

When they sent
the machine over, I
put it through
every benchmark
test I could find.
I finally gave up.
It was the highest
on all of them.

Give me the choice
and I'll use the fast-
est thing I can
get my hands on.
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S T E P

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New by DacEasy is the Breakthru 286 speedup board, the most advanced turbo board for your business dollar. Available in two clock speeds (8MHz and 12MHz), and providing the most cost-effective way to convert your PC (most clones and Compaq portables) so that it's faster than an AT without the expense. Simple 1-2-3 installation of a half card and there's no software required! Software compatibility is universal so all system RAM, hardware, and peripheral cards can be used without modification. Breakthru works with LAN and mainframe communication products and conforms to the Lotus/Intel/Microsoft Expanded Memory Specification (EMS). And included with your board, is DacEasy Lightning , a disk-caching program (*PC Magazine's* 1986 Editor's Best) that retails at $69.95, yours absolutely **FREE**.

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All new, by *DacEasy*, version 2.0, the most incredible spreadsheet value. Simple to use (even for beginners!), yet remarkable for its three dimensional capacity and beautiful graphics. Transport accounting data into Lucid for budgets and proposals without ever rekeying. Winner of the coveted *PC Magazine's* Technical Excellence Award (1987) and *Home Office Computing* Editors' Pick (1988).

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■ **JOHN C. DVORAK**

Bypass: Big Blue's Big Fear

PCs are bypassing Big Blue's big irons, and IBM is fighting back with its traditional weapons—proprietary architectures. But big guns won't wipe out the competition now.

Bypass. It's a term you hear around phone companies. Ask an executive from AT&T "How's the bypass problem doing? Solved it?" You'll end up listening to an hour or more about bypass.
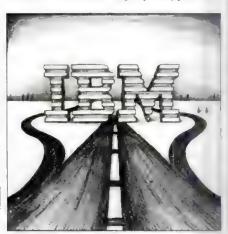
Bypass, in phoneco lingo, simply means to bypass physically the scads of copper wires strung throughout the world. Setting up a private communications link—say, with a microwave dish—between two points is practicing bypass. That's bypassing the phone company lines and (no coincidence) the phone bill. The phone company hates it.

GREEDY LITTLE PCs It's the same with computers. Little machines are bypassing the big machines. While the process isn't called bypass, it may as well be, because the little machines have been taking chores away from big ones for over a decade. There is no end in sight as the next generation of PC chips appears with capabilities approaching those of today's small mainframe and yesteryear's water-cooled monstrosity. (I'm still amused at how the mainframe apologists laughed at the PC revolution when it began.)

It's gotten to the point now that you have to wonder how much computer power the world can absorb. In fact, it's not that we can't absorb limitless computer power; it's that the real mips-sucking applications haven't been invented yet. Software has lagged so far behind the hardware that in all areas of computing, we've run into a brick wall called "lack of need." We simply don't need any more power to

run a business. Unless we want real-time video as a screen background, for example, or some other nonsense, it doesn't take a lot of computer power to do order entry on, say, 16 terminals. By networking groups of these small machines, thousands of them can be linked with little noticeable drain on performance—especially when compared with the performance of a multiuser mainframe loaded with terminals.

BYPASS ECONOMICS It's all bypass. Bypassing the traditional big iron that's installed in the air-conditioned basement and controlled by specialists. The fact is that there are plenty of installations in the U.S. in which 1,000 or more PCs are linked via a network and are doing just fine without the help of a mainframe. In many cases the MIS honchos have been forced to go with bypass techniques because of budget limitations. That's what bypass is all about. You don't think that people bypass the

phone company system because it costs more money to bypass, do you?

IBM always had techniques to deal with competition and bypass when they came in the form of so-called plug-compatible peripherals and plug-compatible machines. It could preannounce a new machine or lowball the market. But what does IBM do with PCs proliferating like mad? It's like fighting a flea attack.

It's gotten so bad that IBM is losing market share and with it, Big Blue's image of invincibility. To combat the attack, IBM does what it does best: looks back toward its roots. Looks at its old ideas and old ways of doing business. Maybe it will revive the IBM songbook. Needless to say, the old way won't work forever.

EXODUS LOST What IBM is doing wrong is ignoring what made its small Entry Systems Division the fastest-growing entity in business history: responsible leadership. IBM, when it made its initial entry into the PC market, had the attitude of Moses when he parted the Red Sea: the sea opened wide and Moses brought the Israelites across to safety. But today's IBM would rather take a boat across the Red Sea with only a few executives on board.

If IBM had not become preoccupied with its Micro Channel patents and closed architecture, I think it would have sold twice as many PS/2s, and there wouldn't be any AT-bus machines sold today. EISA would not exist. More important to IBM, Big Blue would be in the driver's seat, controlling the destiny of the market. Now it's just a target for bypass.

Illustration: Lisa Amoroso

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■ JOHN C. DVORAK

INSIDE TRACK

Hard disk caching controllers that'll make your hair stand on end; IBM's forays into retail; instant on.

Throughput Is the Name of the Game Dept.: There's a thing called Amdahl's Constant. It says that for a computer to perform at maximum efficiency, you need 1 bit of I/O for every instruction per second. A designer friend of mine claims that he can prove that you need at least 1 byte of I/O for every instruction per second. So much for constants. Whatever the case, this means that if a **screaming** 25-MHz 80386 machine produces 6 mips (million instructions per second), then to utilize this power it must have at least **6 megabits of data** flowing in and out of the processor constantly. Otherwise the mips are wasted. It may even require 6 mega*bytes*.

We are kidding ourselves with these computers because with their nominal 125,000 bytes of throughput per second, they are I/O choked. We may as well use a souped-up 8088. Obviously a future trend will be **exploiting** this weak area. The most noticeable example today is the **Konan TenTime** hard disk caching controller. With it, the company says you can expect to effectively **speed up** an ST-506 drive by a **factor of ten.**

This kind of controller is nothing new. Big machines use them. The datapac used in the **Tandon** computer uses one, and the PS/2 also uses the concept. But nobody takes it this far. Other vendors use a caching controller to make the slowest of hard disks seem like faster models. This baby is designed to make fast disks *scream*, or appear to. Unfortunately, benchmark tests are easily fooled by this kind of device (I'm reminded of the Chang modification). One test told me that the average access time was zero! So much for benchmark tests. I don't know what this controller is really doing, but it feels faster than the dickens.

While the Tempe, Arizona–based Konan leads the pack with this somewhat pricey ($595) but **fascinating** controller, expect to see others join the fray soon. The big sleeper in the business is the ultra-successful **CompuAdd.** Although CompuAdd maintains a low profile, don't take the company lightly. I met with the executives of CompuAdd recently and was **impressed** by their breadth of knowledge and enlightened attitude toward cost-effective high-performance machines. They intend to bring out a **caching controller** for the already **speedy ESDI** drives as well as one for ST-506 drives. Konan says it's working on an ESDI controller, too. These should make **your hair stand on end.**

For those of you on a budget, Konan tells me that the most cost-effective **speed-ball** machine is a 12-MHz 286 using its caching controller. I've checked out this combo, and I'd swear I was running a 386 with a CDC Wren drive. I suspect, though, that the 386SX chip will soon kill the 286 chip, and that would be my choice for a **cheap screamer.**

The Mythical IBM Color Portable Dept.: People keep telling me they've seen it. The latest: it comes complete with a full VGA 9-inch flat screen. "It will be announced before Comdex!" they shout. But will they make a bet? No.

I'm hearing more and more about **IBM's trying to get K-Mart and Toys R Us** to carry the Model 25 by Christmas. "It's IBM's last experiment in retailing," I'm told. I can't figure out what these guys are up to anymore. The next thing you know they'll be **selling chips!**

So They Ask Me Dept.: People keep asking me about what laser printer to buy. Canon seems to have a near monopoly on the engines in many of the print-ers, including the HP and the Apple. Meanwhile, I'm shown Xerox and Ricoh and even Panasonic engines. When you go after that laser printer of your dreams, you have to consider **one possible problem:** Where do you get toner cartridges? **Everybody** has Canon cartridges and probably will have them long after your printer is useless. I think that if I were to buy a non-Canon laser printer I'd want one that simply had a **permanent drum** and used liquid (bought by the case) toner you can get from any office supply store. I'd hate to get stuck with an oddball printer that needs an unobtainable cartridge.

Instant On Dept.: Award Software sent me an add-in card containing *DR DOS* in ROM. I had said that a ROM card that brought up DOS instantly (without a disk boot) would be **a boon.** I'm more convinced of it as I watch an 8MB memory test every time I turn on my machine. Do we need to **wait an eternity** for a machine to boot? What's the point of a memory test when the machines never fail? Then there's all the system checking. Come on, I want to turn on a switch and have a **prompt now!** This experimental card from Award does nothing to bypass the nonsense. Here's what we need: **a ROM-DOS card and a new BIOS chip** on the main board. A setup program like American Microsystems' could be told to boot directly from the card or go to a disk. Your option. A small amount of permanent EEPROM or battery-powered RAM on the card could hold CONFIG.SYS and AUTOEXEC .BAT files.

As the systems of tomorrow approach 16MB of RAM (and more!) with all kinds of devices, users will find the **boot time intolerable** when time after time **it accomplishes nothing.** Instant on is what we want to see. **Instant on.** Dell, CompuAdd, Acer, Everex, Compaq, VIPC, SIA, Zenith, *someone* will use a special BIOS and make this an option on its machines. Who will be the first? ▣

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■ JIM SEYMOUR

PCs AND POSTSCRIPT: THE SPEED PROBLEM

Convinced that PostScript-based laser printers are taking over the PC world, Seymour shares the knowledge he's gained from coping with them over the last 2 years.

In *PC Magazine*'s January 17, 1989, issue, I chose the Apple LaserWriter IINTX as one of the outstanding products of 1988. The IINTX, the best of Apple's second-generation PostScript-based lasers, is a superb tool. I use one every day and would find it very hard to go back to a simpler, bitmapped laser as my primary PC printer.

After my article appeared, a number of readers wrote to complain about that choice. Some focused on printer speed when using the LaserWriter. Others reported severe problems—often agonizing and sometimes hilarious—in trying to get PostScript printers to run with IBM PCs and PC clones and with DOS application programs.

Over the past couple of years, I've spent a lot of time coping with the problems of driving PostScript laser printers with PCs and PC application software. My experience has also included addressing the printer-speed issue. I want to pass along some of what I've learned because I believe PostScript-driven laser printers are going to be an increasingly important part of our lives.

I'm convinced that they will become as important in the DOS world as they already are in the Macintosh universe. It's clear that the PostScript page-description language (including the PostScript-language clones that are about to flood the market) has grabbed the spotlight, eclipsing less satisfactory alternatives. I think this momentum can only grow. And I welcome that: PostScript is a *good* standard, unlike some of the less-than-benign PC business standards with which we've become saddled.

In this column, I'll tackle the speed aspects of PostScript printers. You'll have to read my column in the next issue for tips on getting PostScript printers to work with DOS applications.

Printer-speed issues on PostScript machines usually revolve around two factors: the time required to compose complex desktop-publishing pages in the printer controller, and the time required simply to ship the data over to the printer (and its controller) from the PC.

A QUICKER POSTSCRIPT Adobe has made some strides toward faster PostScript page-image composition in the most-recent releases of the language. But these are still relatively modest gains in an area with *lots* of room for improvement. I have built a few 8½- by 11-inch pages with Aldus's *PC PageMaker* that take as long as 20 min-

utes to print—that's for only one copy of one page!—and many other pages that take about 4 to 6 minutes.

If I were printing multiple copies for distribution—in other words, using a PostScript-controlled laser printer as a desktop printing press—even very short press runs would quickly become impossible. But hardly anyone does that—except to run off the occasional quick handbill. Most of the time, we use these printers to prepare reproduction masters. The masters go to a print shop, where they're turned into negatives and plates (or offset paper masters) from which our distribution copies are printed by traditional ink-and-paper methods. But just making the masters takes too long on a PostScript printer.

We can look for substantial speed improvements from the PostScript-clone and PostScript-accelerator work being done by companies such as Phoenix (whose BIOS chips are found in many of the best PC compatibles) and Weitek (whose math coprocessor chips have turned fast 80386 PCs into serious competitors to minicomputers in the CADD business).

So I'd call the speed of today's PostScript printers satisfactory—and about to get a lot better—in terms of the time required to compose a page and send it on to the actual printing mechanism.

The second part of the speed problem—the time it takes to send the data from the PC to the printer—is subject to much easier fixes. The trick is to use a parallel printer connection instead of the serial connection found on so many PostScript printers.

■ JIM SEYMOUR

HAPPIER IN PARALLEL Of course, this problem is unrelated to the PostScript language. Anyone who used soft fonts, or printed graphics images, with the original (non-PostScript) Hewlett-Packard Laser-Jet faced the same dilemma: it took *forever* to send a couple of fonts or a modest-sized graphic over to these early, serial-only LaserJets. When HP introduced the LaserJet Plus (and the replacement motherboard for the original LaserJets, upgrading them to LaserJet Pluses), the company also added a parallel connection, which made a phenomenal difference.

Apple's laser printers, from the early LaserWriter and LaserWriter Plus units through the latest LaserWriter IIs, are still burdened with serial-only hookups. That's fine for Macintoshes, which can drive the LaserWriters only as serial devices. But for PC users, it's frustrating and embarrassingly short-sighted. Apple's own market research shows that a very significant number of LaserWriters are docked next to IBMs and compatibles, all of which are much happier feeding the printer a parallel data stream.

So those who criticize even the nifty IINTX on the basis of slow data-transmis-

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■ While it lacks some of the LaserWriter IINTX's sexy features, QMS's PS-810 may be a better choice for PC users than the Mac-centric LaserWriter.

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sion speed are right on the button: it's a fair complaint.

If you're looking for a laser printer with a PostScript language controller (and the famous 35 Adobe fonts built into ROM), take a look at QMS's superb PS-810. A fast, updated LaserWriter Plus clone, the PS-810 uses the later, superior Canon SX engine and adds that missing parallel connection—plus emulations that range from HP LaserJet Plus to Diablo 630 to HPGL. I use a PS-810 on a second PC in my office and greatly admire this tough, smart machine. While it lacks some of the sexy features of the LaserWriter IINTX, it may be a better choice for PC users than the Mac-centric LaserWriters.

Next time around, we'll take a look at some sneaky tips and tricks for getting your PC applications to work with a Post-Script printer. **PC**

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■ WILLIAM F. ZACHMANN

COMPUTERS, COMMODITIES, AND COMPETITION

Swept by standardization, the PC market differs significantly from a true commodity market. But there's still plenty of room for product differentiation by innovating within the standard.

Recent setbacks for some vendors of high-quality IBM-compatible PCs offer important lessons on the nature of competition in emerging information-systems markets. AST and Wyse, both successful highfliers in the past, for example, have reported poor sales and disappointing financial results for fiscal 1988.

Examining the reasons for the recent troubles at Wyse and AST can reveal not only what these vendors need to get back on track, but also a great deal about the nature of competition in the increasingly standardized world of information systems. The dynamics of the PC market will become the dynamics of the whole information-systems market in the decade ahead.

A simplistic explanation of Wyse's and AST's woes is that they are competing in what really amounts to a commodity market for IBM-compatible DOS-based PCs, where intense competition will make it difficult to achieve decent profit margins. Superficially, that seems to be a plausible enough explanation, and it has been advanced by some analysts.

MARKET DYNAMICS It is certainly true that the PC market is much more commodity-like than the market for traditional mainframe and minicomputer systems. The proprietary architectures and operating systems of traditional systems have served to fragment the market and to lock users into a single vendor's environment. Differentiation has protected vendors of traditional systems from competition and has let them engage routinely in what

amounts to semimonopolistic pricing.

Nevertheless, to assume that standardizing the PC market makes it a commodity market is misleading. The PC market is very different from a true commodity market in extremely important ways—above all, in the role that innovation plays.

In information systems, *standardization* means something far different from *homogenization*. That two products conform to the same standard or standards in no way implies that they are identical. The ways in which those products differ can help define their value to buyers and determine their fortunes in the marketplace.

There is no denying that the PC market is highly competitive. Not all vendors, however, encountered the difficulties that Wyse and AST did late in 1988. Compaq's results were in line with a generally strong performance throughout the year, for example. Dell Computer also charged ahead, as did Tandy. Even some relative new-

comers, like Everex, fared very well.

But when you look a little bit below the surface, you find the reasons for the difference. Success in the computer market depends largely on how actively a vendor maintains a market edge through effective innovation.

EARLY INNOVATORS Wyse was one of the first vendors to deliver an AT-compatible system built around an Intel 10-MHz 286 a couple of years back. It was then that Wyse first established itself as a reliable, credible vendor of high-quality PCs. Offering substantially better performance than IBM and most other vendors was a key to that early success.

AST distinguished itself by offering performance a cut above the competition's at a price a cut below. The AST Premium/286 marched quickly to the top of the 286 performance charts with a 12-MHz system offering better performance than Compaq's in a quality system at a lower price.

From the start Compaq has set itself apart by repeatedly offering innovative yet standard systems. The first was an IBM-compatible transportable. Compaq was one of the few vendors to bring out a 10-MHz and then a 12-MHz 286 system as early as or earlier than Wyse and AST. Then, months before IBM, Compaq was the first vendor to bring out an AT-compatible system based on the Intel 386.

THE KEY TO SUCCESS Compaq still remains ahead of IBM by many measures of 386 system sales. It was also first to de-

■ WILLIAM F. ZACHMANN

liver a 25-MHz 386 desktop system and the first to bring out an excellent 386 portable with a high-quality display. Recently, the Compaq SLT broke new ground for a high-performance hard-disk portable that could really run on a battery.

Dell and Tandy, too, have maintained their growth with solid innovation. With these two vendors, part of the innovation has taken place in distribution and market-ing. But both have also relied on significant innovation in their product lines for success. Recently, Dell has become a leader by launching a small-footprint 20-MHz 286 as well as by maintaining a strong line of 386-based systems. Tandy has prospered by building low-cost consumer-oriented systems that its wide distribution network can sell successfully.

Both Wyse's and AST's recent, hopefully temporary, setbacks can be attributed largely to their not having continued to stay ahead of the competition when it came to innovation within the standard. Neither has led the way in bringing out superfast 286-based systems, as Dell did, and Wyse has been slow to roll out 386-based PCs.

AST came relatively early to market with a 20-MHz 386-based product, but—unlike AST's Premium/286—its Premium/386 did not turn out to be the performance demon that many expected. It is certainly fast and reliable; however, it did no better than match the performance of Compaq's 20-MHz Deskpro/386 and was less aggressively priced relative to Compaq's and IBM's systems than the Premium/286 had been. And AST was well behind the competition in bringing a 25-MHz 386 machine to market.

ROOM AT THE TOP So products like Everex's Step 386/25 and the Dell System 325 now vie for the spot at the top of the performance charts held by AST's Premium/286 a couple of years ago. It isn't hard to see why Dell continued to do well and Everex has proved to be a major new contender in quality DOS (and now OS/2) systems while AST and Wyse have fallen behind. To recoup their market success, these vendors need to regain the lead in innovation that they had previously held.

The most important lesson is more general than the fate and fortune of any one vendor. It is that even in what is supposedly a commodity-like market, there is room for vendors to earn a competitive advantage through effective innovation within a standard. As the wave of standardization rolls over even the largest systems in the years ahead, it brings a lesson that both the traditional mainframe/minicomputer vendors and the aggressive newcomers to the era of information systems can ignore only at their peril. ▣

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■ STEPHEN MANES

ELECTRONIC PAPER: IS THAT "GUM" OR "GUB"?

New hardware and software let you mark up screens with the scribbles you heretofore reserved for Post-its. Can electronic penmanship courses be far behind?

I hate to say I told you so, but I don't get many opportunities to gloat around here. Three years ago, when the phrase "paperless office" was as ubiquitous as "Oprah's diet" is today, my fortnightly remarks here appeared under the headline "Paper Is Truth."

Today paper isn't just truth: What You See Is What You Get has become the paradigm for The Way We Compute Now. The approved way to think of your machine is in terms of something you know well: your paper-strewn desk. Computer screens increasingly look and act like pieces of paper, with the eventual goal of producing real ones.
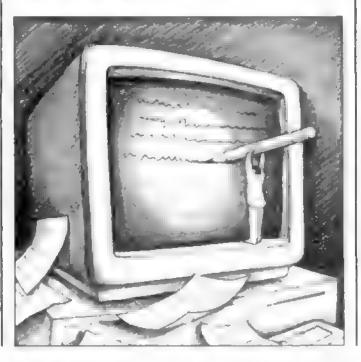
Laser printers made all this possible.

The link between what you do on the screen and what you get on paper has become so intimate that eons of software-development time are now being devoted to it. Programs like *Allways* even refine that link for software born in the brain-dead past when people still believed 80 columns and 24 lines could describe the world better than 8½ by 11 inches.

Given all this, what's surprising is the persistence of horizontal monitors. Vertical-format monitors have been around for years—even the long-gone CPT word processors used them—yet most of us still put up with tiny horizontal screens that don't begin to reflect our work. IBM doesn't seem to have noticed; it's probably waiting to put the final touches on a 20MB OS/2 big-screen version of *Displaywriter* or to introduce yet another line of horizontal monitors: say, SBVGA, the SB standing for "slightly better."

VIRTUAL PAPER But then there's Wang's new *Freestyle,* perhaps the ultimate in paper-metaphor systems. The program can capture any PC screen (OK, any Hercules screen) and turn it into a piece of "virtual paper," which you can then mark up by hand, type on, and transmit to a printer, a fax machine, a network, or multiples thereof.

If you keep your pages in electronic form, you can even attach audio messages to them—in sync with your markup. As you draw ominous circles and arrows and lightning bolts toward a negative number on a spreadsheet, you can shout, "Get these figures in line or get in the unemployment line!" The hapless serf to whom you post the message over your network can then don a headset and play the whole drama back on his screen, complete with your animated scribblings and offscreen screams. Using a videotape-like control panel, the serf can even "rewind" and

"fast-forward" through the whole scene to receive additional chastisement.

The *Freestyle* user interface is the first I've seen in a long time that doesn't smack of either rip-off or blind adherence to one-shot studies from Xerox PARC. Ask Stephen R. Levine, director of Wang's Office User Interface Department, where the whole thing came from, and he responds, "I had an idea." The product looks that way—genuinely original, rather than a vague improvement on a previous version of a previous version.

BURNING RUBBER The single best aspect of any user interface I've seen in ages is the "electronic pencil" that comes with *Freestyle*'s graphics tablet. Though its body is muted office-gray instead of Ticonderoga yellow, you just know the thing is a pencil because it has a little pink "eraser" on top. And—wonder of wonders, stroke of pure genius—that eraser actually lets you rub out your mistakes. Learning curve? Nil.

Freestyle's on-screen "desk" displays one- by one-inch "stamps"—electronic reductions of full pages—in a resolution much better than you'd expect. A "stapler" icon lets you attach pages to each other, and another icon that looks for all the world like a Bates staple remover lets you reverse the process.

Wang offers a bunch of reasonable scenarios for the program—particularly cases where proposals and authorizations must be marked up and/or signed off on by a multitude of hands. The catch? *Freestyle* is pretty pricey and rather limited.

■ STEPHEN MANES

Freestyle doesn't offer even tepid links to the program that generates the screen. If you get a nastily notated spreadsheet page, about all you can do, aside from sending back a humble promise to do better next time or committing hara-kiri, is exit *Freestyle* and fiddle around with the real spreadsheet in *Lotus 1-2-3, Microsoft Excel*, or whatever. But you'll either do a lot of flipping into and out of *Freestyle* or print out the notated page; there's no windowing software to let you keep everything on the screen at once. And *Freestyle* doesn't work in color yet; Hercules is the only standard supported thus far.

Worse: Although the system will run on PC ATs and compatibles, the only compatible network thus far announced is Wang's *VS Office* (though LAN support is promised). The only other pseudonetwork option is group III fax, which of course won't retain any of the audio notations.

And there's a sense in which the whole system seems really designed to dazzle and placate high-level executives who absolutely refuse to learn to type or commit resources to developing systems that could handle information in a more efficient, more totally electronic way that might *not* happen to emulate sheets of 25-pound bond, but instead do something better.

Although there are obvious reasons to extend the paper metaphor all the way to on-screen handwriting, they may well pale before the better reasons to abolish handwriting altogether. As anybody who's seen my signature can tell you, handwriting tends to be weird, illegible, and ambiguous. You can just see the underlings scrambling to decipher the boss's pixelated electronic chicken scratch; half the traffic of *Freestyle* documents will undoubtedly be memos to the boss's secretary with little notes asking, "Does this say Hergesheimer, Hildesheimer, or Nozzle?"

So the cost-effective solution may be to send the boss to typing school and computer college. A low-end version of *Freestyle* will cost a couple of grand per workstation; the sound-annotation feature adds another $1,500 per desk; a fax board, scanner, and vertical-format high-resolution monitor can bring the *Freestyle* price to over ten grand, not counting the printer. If the CEO is making, say, a quarter million a year, the money you'd spend on sending him or her to keyboard camp for the summer would pay back handsome dividends in equipment savings—not to mention the workers' delight in the boss's newfound humility.

You say no two-fisted real-world American executive would submit himself to such humiliating but economically sensible reeducation? Well, a bunch of young turks are just itching for his job, and guess what? They all use screens a lot more than they use paper, and they all know how to type. **PC**

CROSSING FORMAT FRONTIERS

LOW-HASSLE SOLUTIONS TO DATA TRANSFER

DATA TRANSFER CAN BE A PAIN. True, getting your data files from a 3½-inch 720K diskette to a 5¼-inch 1.2MB diskette presents no insurmountable technological challenges, but low-tech hassles like this can sap the productivity of an office, especially if the user isn't a PC guru.

For instance, when you consider buying into IBM's PS/2 line, IBM would like you to think of the Micro Channel architecture, increased video resolution, and enhanced reliability. But for most users, the biggest issue remains: How am I going to share information between my old PC and the PS/2?

In this issue, *PC Magazine* explores data transfer and media conversion: how to move information between desktop PCs and PS/2s, laptops, Macs, or mainframes efficiently, and also how to translate between data formats of competing programs, especially word processors.

CHOICES, CHOICES What on earth should you do? Here, in a nutshell, is a summary of the best way that you can move infor-

Tested for use at 800 BPI th

mation among MS-DOS computers:

First, use your LAN. If you already have a network, you're home free. You can move files among classic-bus PCs, PS/2s, and often Macintoshes; and, with the proper gateways, you can access and download mainframe or minicomputer data. If you don't have a network yet, file sharing is not a sufficient cost justification. With or without a LAN, you'll still need something else to move information off most laptop PCs.

You can install a 3½-inch drive in your PC. This is the best, most idiot-proof way to integrate a classic-bus desktop PC (one with a 5¼-inch disk drive) and either a laptop PC or a PS/2 with 3½-inch drives. Typically, you'll leave the 5¼-inch drive in place as the A: drive and add a new B: drive. New PCs support 3½-inch drives directly; older machines may require a special software driver (supplied with the drive) or a BIOS update. Some vendors will sell or give you a new ROM BIOS only if you buy the drive from them.

Always get a 1.44MB drive rather than 720K. The cost difference is minimal, and, unlike the case with 5¼-inch floppy disk drives, the higher-density 3½-inch disk drive can reliably read and write lower-density disks. Internal 3½-inch drives are cheaper than external drives, and reliable mail-order drives are cheaper still. Compaq, for instance, asks $245 list for a 1.44MB drive; our Editor's Choice drive from PC Connection costs $119.

If you don't have a drive bay free or you don't want to add an external drive, you may want to get a file transfer program. *Lap-Link Plus* and *The Brooklyn Bridge* are the best-known of this genre. You get a cable that connects the serial ports of your two PCs (or PC and laptop) and a communications program that tricks the serial ports into running at 115,200 bits per second—about the speed of a floppy disk—instead of the usual COM port limit of 9,600 or 19,200 bps. The software lets you transfer individual files, file groups, or entire directories. You'll find more similarities than differences among the programs; essentially, you can't go wrong with any one. If you're upgrading to a new PC, you can transfer the contents of your entire hard disk over a long lunch hour at a rate of 1MB every minute or two. Some file transfer utilities now have faster parallel-port versions that work on some PCs (older PCs could send but not receive data via the parallel ports).

If your file transfer needs are minimal, you can get by with compatible communications software on both computers and a

Solving the annoying problems of data transfer and media conversion can lead to big productivity gains. PC Labs looks at solutions for easier exchange between PCs and PS/2s, laptops, mainframes, or Macintoshes.

null-modem cable or adapter. A null modem is not a Hayes-compatible modem; it's a plug or cable that crosses the two PCs' transmit and receive data lines (pins 2 and 3) and interconnects several other pins. You could build your own if you have time on your hands, but your best bet is to buy a null-modem adapter and a female-at-both-ends connector, each $7 to $8 at Radio Shack, in combination with an existing serial cable. For software, you can also use *PC Magazine*'s ZCOPY, a free utility that performs bare-bones file transfers (see the Utilities column "File Transfers Fast and Easy," *PC Magazine*, February 28, 1989, for information on ZCOPY and for a diagram of a null modem). But by the time you hunt down all the parts, you'll have spent as much effort as if you'd bought *Fastwire* or *The Brooklyn Bridge* in the first place.

If you're not ready for a network but you want to share a printer and send messages as well as share data, investigate a two-person BS net. Think of the boss/secretary net as *Lap-Link* gone upscale. Unlike low-cost LANs, such a network doesn't require you to have a network card. Data moves across the serial port at distances of up to 100 feet. Products you may want to took at include Traveling Software's *DeskLink* and Tandy's *DeskMate Workgroup Companion*.

Other data-transfer solutions are possible. If both machines involved have tape backup units, you can make a backup of files on machine A, then restore to machine B. You can do the same with removable mass-storage disks from Sysgen, Tandon, Plus Development, or Iomega (see "Removable Mass Storage: You Can Take It with You," *PC Magazine*, September 13, 1988). You can attach an external 5¼-inch floppy disk drive to your laptop or PS/2. If all else fails, you can e-mail a message from machine A to machine B.

MACINTOSHES To share data among PCs and Macintoshes, you can use networks (the best choices are *AppleShare*, Novell's *NetWare* 2.15, Sun Microsystem's *TOPS*, and most anything from Digital Equipment), specialized floppy disk drives (some Macs now write DOS disks directly), data transfer programs, or Mac add-ons that let you run DOS programs di-

rectly. Some Mac add-ons also convert MS-DOS data into Mac-usable formats, especially for word processors. Because IBM is Goliath to Apple's David, the preponderance of interest lies in accessing and running MS-DOS software on the Mac, not the other way around. Try to buy software that uses the same data structure on both machines, such as *Microsoft Excel* and Aldus's *PageMaker*.

DATA TRANSLATION Once you get the data moved, you may have to translate it for use with your program. On PCs, data translation issues center on word processing format-conversion programs. Increasingly, you'll see word processors that do the translations themselves, such as Borland's *Quattro*, Ashton-Tate's *MultiMate Advantage II*, Software Publishing's *PFS:Professional Write*, and Microsoft's upcoming *Windows*-based word processor. Some word processors accept files based on IBM's Display Content Architecture (DCA). Microsoft is trying to gain support for its Rich Text Format (RTF).

Major spreadsheets and databases typically use the file structures of the market leaders, *Lotus 1-2-3* and *dBASE III Plus*, as common translation standards. You can also save database files as comma-delimited ASCII files.

Graphics programs have an emerging standard, the Computer Graphics Metafile (CGM). But beware: you often get good-enough-for-government-work translations, with slightly thinner or thicker line widths. Or you may find that a once properly positioned label now covers an important part of your illustration. For programs that run under *Windows*, you can use the *Windows* clipboard to cut and paste.

Many presentation graphics programs can import and enhance Lotus's scratchy graph (.PIC) files. Most CADD programs can translate Autodesk's *AutoCAD* (.DXF) files, and many paint programs use the *PC Paintbrush* (.PCX) format. But not all .PCX files are equal; different versions of the same paint program can produce noninterchangeable files.

If you work frequently with graphics, you may want *HiJaak*, an $89 utility from InSet Systems (12 Mill Plain Rd., Danbury, CT 06811; (203) 794-0396) that converts ten graphics file formats on the

PC and Mac. It's a godsend for anyone who does desktop publishing. *HotShot Graphics*, Version 1.5, a $249 package from SymSoft (444 First Street, Los Altos, CA 94022; (415) 941-1522) also does graphics format conversions, although its forte is capturing and editing screen images for later printing.

If you still have an old CP/M computer, you may need to access its data. One strategy is to use comm programs for serial-cable data transfer. Alternatively, two utilities let your PC read CP/M disks: *Uniform* from Micro Solutions (125 S. 4th St., DeKalb, IL 60115; (815) 756-3411) and *Xenocopy* from Xenosoft (1414 Sixth St., Berkeley, CA 94710; (415) 525-3113).

If you want to take data off a mainframe—especially numeric data—you'll be most efficient if you don't have to wrestle the data into a spreadsheet. Some software for *Lotus 1-2-3* and now *Microsoft Excel* not only translates or reformats data, but knows how to hunt it down on the mainframe using products such as *Tempus-Transfer* and *Tempus-Access* from Micro-Tempus or *View/PC* from DB/Access. Prices can range from $250 to $20,000.

WHAT WE TESTED *PC Magazine*'s report on data transfer and media conversion covers five areas:

■ Data transfer programs, including *Direc-Link, Fastwire II, File Shuttle, Lap-Link Plus, Paranet Turbo, Rapid Relay Easy*, and *The Brooklyn Bridge*.

■ Buying and self-installing 3½-inch floppy disk drives, both internal and external models.

■ Word processor format conversion.

■ Using nine-track-tape units on PCs to transfer mainframe data.

■ Moving files between PCs and Macintoshes, translating file formats, and running MS-DOS programs on a Mac.

We tested for speed of data transfer, ease of installation, and accuracy of the conversions. Within each section, products are arranged in alphabetical order—by company name for hardware, by product name for software.

—Bill Howard
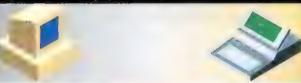
Bill Howard is an executive editor of PC Magazine.

Data Transfer: How to Get It from Here to There

Solutions are listed in descending order of preference, based on simplicity, desirability, and bang for the buck. The representative products listed have been chosen because they are the best in their class or the best-known. Examples are generally stated and may have exceptions (for instance, if you use MCI Mail and *Lotus Express*, you can transfer program and graphics files, not just text files, via electronic mail). Price ranges are approximate.

A desktop PC with a 5¼-inch disk drive must share data with a laptop that uses 3½-inch disks.

SOLUTIONS:

- Install a 3½-inch floppy disk drive as drive B: in the desktop PC. Older ATs and PCs will need driver software. $120-$250.
- Use a data transfer program for serial or parallel transmission. The speed is comparable to floppy disk access. *The Brooklyn Bridge, Lap-Link Plus.* $55-$160 including cable.
- Add an external 3½-inch disk drive—only if the PC's internal bays are filled. Manzana MicroSystems, Sysgen. $300-$400.
- Buy an outboard 5¼-inch drive (usually 360K) from the laptop manufacturer. $200-$400.

- Send text files (not programs or graphics) back and forth via electronic mail. MCI Mail, EasyLink, AT&T Mail. Typically $1-$2 per message.
- Connect PC and laptop with null-modem cable, null-modem plus serial cable, or SmartCable, using compatible communications programs on both machines. The speed is 1/10 that of *Lap-Link*-type programs. $10-$75 plus software.
- Use a null-modem cable with *PC Magazine's* ZCOPY, a limited-function file transfer program. Free.

PC 5¼-inch data must be sent to PS/2 3½-inch format.

SOLUTIONS:

Consider all desktop-to-laptop solutions above, or:
- External 5¼-inch floppy drive on the PS/2. Sometimes limited to 360K. Sysgen, IBM. $200-$400.
- BS (boss/secretary) network. Allows sharing disk drives and printers and sending brief messages. Use serial port and telephone wire. *Desk-Link, Tandy Workgroup Companion.* $150-$300.
- Removable external hard disk. Transfers 10MB to 40MB at a time. Bernoulli Box, Plus Passport.

Tandon Personal Data Pac. $600-$1,500.
- Tape backup. Backs up and restores files among PCs. $350-$1,000 per PC.
- Network. $200-$1,000 per PC.
- IBM Data Migration Facility. One-way only (PC to PS/2) via parallel port. Use printer cable plus $33 Data Migration Facility plug.

A PC needs to share mainframe data.

SOLUTIONS:

- PC-to-mainframe gateway. Requires PC connected to network, network server connected to mainframe.
- Terminal emulator (IRMA) cards. Requires dedicated cables running to the mainframe, which may become expensive.
- Remote dial-up. Requires a PC, modem, and communications software with terminal emulator.

- Nine-track tape. Uses a tape drive connected to the PC or network.
- Third-party data-conversion services. Will transfer nine-track tape to diskettes or tape cartridges.
- Hand scanner. Can read in chunks of a mainframe data printout. Saba Handscan, TransImage 1000.

A PC needs to communicate with a Macintosh.

SOLUTIONS:

- File transfer program. *MacLink Plus, Lap-Link Mac.* $140-$200 including serial cable.
- On PC (with 3½-inch drives): Copy II PC Deluxe Option Board. Lets PC write Mac-format disks. $160.
- On Mac: 3½- or 5¼-inch external PC-compatible drives. DaynaFile, Apple PC 5.25 Drive. $500-$1,000.
- On Mac: Internal PC-compatible floppy disk drive. Mac IIx, Mac SE/30 FDHD. $599.
- Electronic mail. Primarily for unformatted text or simple data files. MCI Mail, AT&T Mail, Easy*Link.

- Tape backup. Backs up and restores files between the PC and the Mac. Irwin Magnetics, Tecmar. $400-$1,500.
- Networks that support Macs and PCs. *AppleSharePC, NetWare 2.15, TOPS, DECnet.* Typically $149-$349 per node.
- File-compatible programs (to be run on transferred files). *Page-Maker, Microsoft Excel.*
- Devices to run PC software (however slowly) on the Mac. AST Mac286 hardware emulator, $1,499; *SoftPC* software emulator, $595.

Data in incompatible software formats must be translated.

SOLUTIONS:

- Word processors: Format conversion programs are available. *Software Bridge.* $100-$1,000.
- Word processors: Some high-end software supports the DCA (IBM) or RTF (Microsoft) standard, permitting on-the-fly translation. *PFS:Professional Write, MultiMate.*
- Spreadsheets: All major programs import and export *Lotus 1-2-3* .WKS and .WK1 files on the fly.

- Databases: Many programs import and export *dBASE*'s .DBF format, and most handle comma-delimited files.
- Graphics: CGM (Computer Graphics Metafile) is emerging as a standard despite inexact translations. Many programs import and some export *Lotus 1-2-3*'s .PIC format.
- Also, scanners can be used to read in printed manuscripts and spreadsheets, including formatting. Slow, indirect, and error-prone.

FILE TRANSFER SOFTWARE
BUILDING BRIDGES BETWEEN MACHINES

BACK IN THE OLD DAYS (CIRCA 1986), when 360K and 1.2MB 5¼-inch drives were the floppy disk drive standards, it was feasible to use DOS's COPY, BACKUP, and RE-STORE commands to transfer data from one computer to another. The introduction of laptops and IBM PS/2 machines changed all that, making the 3½-inch floppy disk drive and the accompanying 720K and 1.44MB formats standards in their own right.

This double standard has created something of a data transfer dilemma, but there are solutions. For instance, you can add 3½-inch floppy disk drives to your machines (see "Driver's Ed: Choosing and Installing a 3½-inch Drive"), but that can be an

You can't build a bridge without cables, and if you want to send files quickly between two PCs or from a laptop to a PC, you'll need some software as well. PC Labs tests seven file transfer packages.

expensive proposition for fully computerized workplaces. Telecommunications can also be an effective solution, but most communications programs limit you to a 2,400-bit-per-second transfer speed.

LANs are another alternative, but they're too expensive to serve as data transfer vehicles alone. You might even go so far as to hook up two machines via serial cable and use DOS commands to send files from one computer to another, but that's an awkward method at best, and it's not likely to appeal to the layman.

So what's the best way to transfer files when both money and speed are factors? Data transfer programs qualify on both counts. The products we
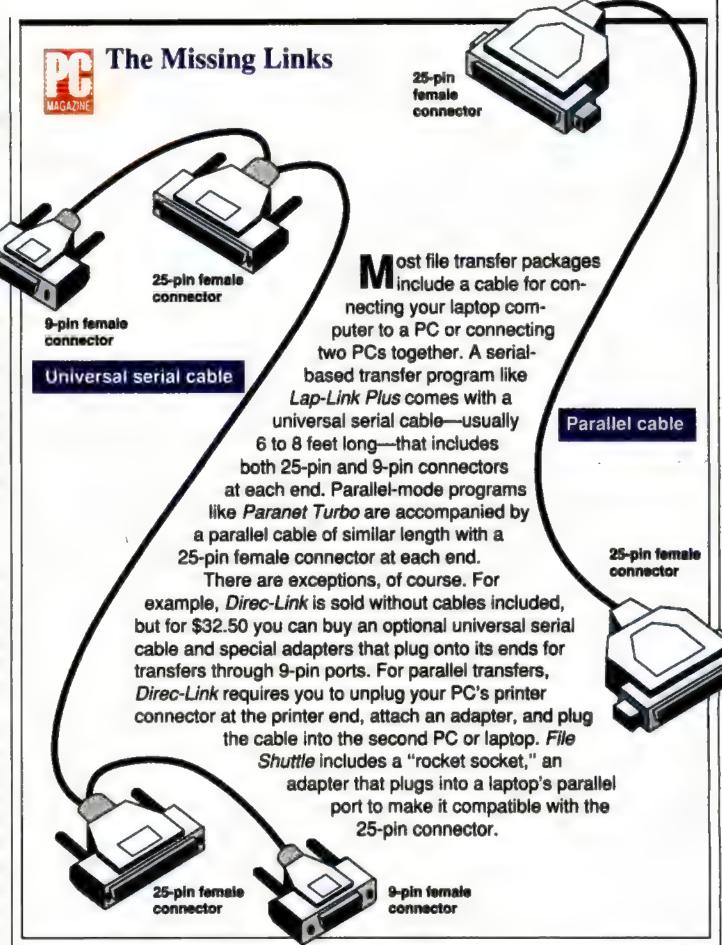
review here—*The Brooklyn Bridge, Direc-Link, Fastwire II, File Shuttle, Lap-Link Plus, Paranet Turbo,* and *Rapid Relay Easy*—range in price from $55 to $159.95 (including cabling) and can send data across parallel or serial cables at a pretty quick clip. Not to be outdone, *PC Magazine* offers its own free utility, ZCOPY, which has many of the same features offered in these programs (see PC Lab Notes, February 28, 1989). You can also build your own null-modem cable (see PC Lab Notes, January 14, 1989) or pick up a cable and adapters at Radio Shack for under $20. Two programs looked at in the past are not evaluated in this review. The newest version of Platte River Associates' *Duette* was unavailable at the time of review, and IBM's own *PS/2 Data Migration Facility* allows transfers only from standard-bus PCs to PS/2s, making it an incomplete solution.

COMMON FEATURES All of these packages have certain features in common, including the ability to transfer multiple files via a file-tagging method. Group deletion of transferred files from the source machine is also available in most of the products we reviewed.

While these are the most-obvious desirable features in file transfer software, other options are important to watch out for, too. For instance, file and directory management functions can make it easier for you to find and organize the files you need to transfer. Especially interesting are some software's provisions for automating file transfer of periodically updated files or other data that you transfer on a regular basis. While some of the products we reviewed accomplish this through scripts and macros, others rely on forms and DOS batch files.

EASY OPERATION Transferring files with these programs isn't difficult, and many of the products we reviewed further facilitate matters by offering you a choice of interfaces. Most of the packages allow you to choose between an on-screen menu—often with the file listings for each computer displayed on a split screen—and a DOS command line mode. *Fastwire II* adds a form-mode interface to aid in auto-

The Missing Links

25-pin female connector

25-pin female connector

9-pin female connector

Universal serial cable

Parallel cable

25-pin female connector

M ost file transfer packages include a cable for connecting your laptop computer to a PC or connecting two PCs together. A serial-based transfer program like *Lap-Link Plus* comes with a universal serial cable—usually 6 to 8 feet long—that includes both 25-pin and 9-pin connectors at each end. Parallel-mode programs like *Paranet Turbo* are accompanied by a parallel cable of similar length with a 25-pin female connector at each end.

There are exceptions, of course. For example, *Direc-Link* is sold without cables included, but for $32.50 you can buy an optional universal serial cable and special adapters that plug onto its ends for transfers through 9-pin ports. For parallel transfers, *Direc-Link* requires you to unplug your PC's printer connector at the printer end, attach an adapter, and plug the cable into the second PC or laptop. *File Shuttle* includes a "rocket socket," an adapter that plugs into a laptop's parallel port to make it compatible with the 25-pin connector.

25-pin female connector

9-pin female connector

matic file transfer, while *File Shuttle* offers a unique twist by supplying foreign-language interfaces.

Several of the programs also let you view the file before you transfer it, though this is mostly limited to an ASCII file display. Micro-Z's *Direc-Link* offers a hexadecimal view as well. Other interface amenities include the ability to temporarily exit to DOS and execute other programs.

A few entrants in the latest crop of transfer programs have moved ahead of the competition by including the ability to take complete control of the host comput-

er's drives and printer. Though the connected computer remains out of operation while you access its peripherals, this is a great way to share hard disk drives, tape drives, and fast printers.

While none of the products are slouches, their speed is tied in with the type of cable used: serial or parallel (some programs make both options available). Serial cables can range from 50 to 200 feet (and even further with signal boosters), but the connections are slower: on large files they often achieve half the speed of parallel configurations. Parallel setups, however, are

constricted by a 15-foot cable length limitation and by the frequent need to unhook your printer to string computers together.

All but one of the programs tested, *Direc-Link*, come standard with the cable or cable adapter. *Direc-Link* works with either a serial or parallel cable, and Micro-Z will furnish the serial cable for $32.50 or the parallel cable adapter for $20. However, you might just prefer to make one yourself, as the manual includes a diagram that will take you through the process. Another possibility is to get the Smart Cable, $39.95 from IQ Technologies, which detects and adjusts to your needs. Since it's more expensive than other cables, however, you should probably consider it only if you plan to use it for other purposes.

None of the products we tested will fall down on the job, and in general they're easy to use. You really couldn't go wrong ordering any of them. The best way to make your decision is to consider the factors that are important to you and then choose the software that has the speed, special features, transfer capabilities, and interface that best suit your needs.

The Brooklyn Bridge

The Brooklyn Bridge was one of the first file transfer programs on the market, intended specifically for sharing files between laptop and desktop PCs. The $139.95 White Crane Systems product has matured since its introduction 3 years ago, and now it easily qualifies as the most full-featured—and one of the fastest—file transfer programs around.

In its previous versions, *The Brooklyn Bridge* worked via serial connections alone. The recent addition of a parallel version lets you achieve levels of speed performance not possible with the serial port version. Both versions go out of their way to make connections easy: serial cables can be connected to COM1, COM2, COM3, or COM4, and parallel connections can be made via any of the four LPT ports. Each version is priced at $139.95 and both offer the same functions, but the software, manuals, and cables supplied with each package are different.

Many of our complaints about earlier versions of the product have been addressed in the latest release. *The Brooklyn*

Bridge's old DOS command line interface, while simple to use, didn't improve much on DOS's own file transfer capabilities. An enhanced version of that original interface, which now includes the ability to access the host computer's printers, tape backup units, and drives, is still there, but the program also now sports a new menu-driven interface mode.

If you use the menu method, you no longer have to change your CONFIG.SYS file to include exact DEVICE commands, a relatively easy though irksome task for experienced users but a bewildering one for beginners. The advantages of this mode include simple horizontal moving-bar menus, split-screen displays for files on both computers, program control using

Options too

numerous to mention

abound in

the new version of

White Crane

Systems' *The*

Brooklyn Bridge.

only the cursor and Enter keys, file tagging, and a whole slew of file management features.

Options too numerous to mention abound in the new *Brooklyn Bridge*, and the 234-page manual includes all the information you need to make this program hum. In addition to the reasonably common file-sorting, directory control, and ASCII file view features, the menu method includes a utility that lets you install and run *ARC* (a file compression program not supplied with *The Brooklyn Bridge*), and up to six other utilities directly from *The Brooklyn Bridge*'s menus. The Copy and Backup commands improve on DOS's versions by letting you save copies of files

on multiple diskettes.

Installing both the menu and command line methods on your hard disk drives isn't a bad idea. You can rely primarily on the menu method for file transfer and use the command line version to access the remote machine's peripherals and drives. While the command line method does change your CONFIG.SYS file, the installation program offers you help in setting it up.

The Brooklyn Bridge is still missing some important features: for instance, it doesn't have a macro mode or its own script language, although you can run DOS batch files to automate file transfer. Another disadvantage is that *The Brooklyn Bridge* uses a master/slave relationship: in both the command line and menu methods, the program is run from just one computer. If you want to transfer files from the slave machine, you'll need to restart the program from that machine so that it can act as the master.

Despite this, *The Brooklyn Bridge* is the most mature file transfer product on the market, with more functions and features than any of its competitors. While it may be too high-priced for anyone who just

The Brooklyn Bridge's menu-method operating display includes a split screen listing files from both the local and remote drives.

It's easy to change program settings from Direc-Link's customization screen. This screen can be pulled up at any time while running the program.

is hook up the two computers with the proper cable. You don't have to make any changes to your CONFIG.SYS or to your AUTOEXEC.BAT files. Running Direc-Link's LINK.COM tells you if the connected computers are communicating successfully. If they're not, just move to the customization screen to reset any communications parameters. You can adjust other program features from here as well, including display appearance and default files.

Micro-Z is also the maker of the Direc-Tree DOS shell, so it's no surprise that when Direc-Link (in menu mode) looks at a new drive, it displays its entire contents in a tree structure.

Among Direc-Link's features is a global file-transfer option that can use a specifically set file mask, such as *.WK1, to search an entire drive and transfer all files in all its subdirectories that have that file extension. You can also mask subdirectory names to limit transfers to those areas.

Direc-Link is easy to install. All you have to do is hook up the two computers with the proper cable and let it run.

Other transfer options include copying entire subdirectories with a single command and file tagging. File management functions include sorting by name, extension, size, or date. You can also view a file in either ASCII text or hexadecimal mode.

Direc-Link also allows you to control transfers and start script files directly from the DOS command line. You can perform automatic file transfers by including the Direc-Link startup command in a DOS

needs to transfer a file occasionally, users whose needs are more extensive should check it out.

Direc-Link

Straightforward, fast, and practical, Micro-Z's Direc-Link, Version 3.0, is a particularly good buy that offers both parallel and serial operation, fairly speedy file transfer, a powerful but simple menu interface, and control from either of the two connected computers. Command line operation and script files offer expert-level capabilities, too.

Direc-Link sells for $59.50 without any cables or adapters, making it one of the most inexpensive options for users who already have or can build the appropriate cables. If you want to buy the hardware, Mi-

cro-Z offers a combination double-headed 9-pin and 25-pin shielded serial cable for $32.50; the parallel cable adapter, a short cable that attaches to your normal parallel cable, costs $20. You can buy a kit with both cabling options for $45, a good idea if you travel and are likely to hook up to a variety of PCs.

Direc-Link's parallel connection can use ports LPT1 through LPT4; the serial connection offers similar flexibility by accommodating all four COM ports. The parallel connection is faster, but in general, Direc-Link is not a speed freak. Our performance tests showed that on the two largest tests Direc-Link in parallel mode was faster than all the serial-mode programs, but slower than the other parallel-mode programs.

To install Direc-Link all you have to do

File Transfer Software: Summary of Features

(Products listed in ascending price order)
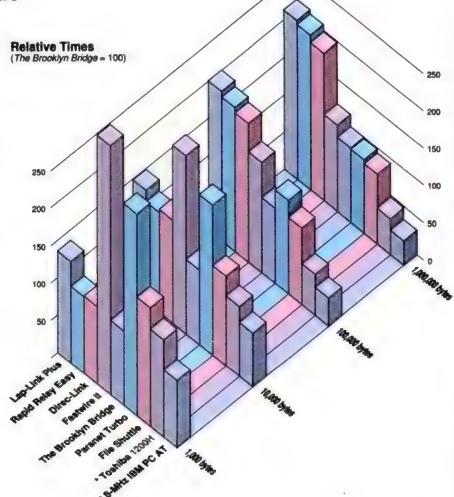
	Paranet Turbo $55.00	Direc-Link $59.50	Rapid Relay Easy $69.95	File Shuttle $119.95	Fastwire II $129.95	The Brooklyn Bridge $139.95	Lap-Link Plus $139.95
SETUP							
Cabling							
Serial or null-modem cable required	O	●	●	●	O	●	●
Parallel cable required	●	●	O	●	●	●	O
Cabling provided	●	O	●	O	●	●	●
System requirements							
RAM	192K	64K	256K	256K	256K	64K	192K
Ports	Parallel	Serial or parallel	Serial	Serial or parallel	Parallel	Serial or parallel	Serial
Device driver	O	O	O	O	O	●	O
Compatibility							
Runs with IBM PS/2	●	●	●	●	●	●	●
Uses OS/2	O	O	O	O	O	O	□
Uses LIM EMS 4.0	O	O	O	O	O	O	O
OPERATIONAL FEATURES							
RAM-resident operation	●	O	O	O	O	O	O
Calls to DOS from within program	●	●	●	●	●	●	●
Data compression	●	O	O	O	O	O	O
Command-line user interface	O	O	●	O	●	●	●
Bidirectional control	O	●	●	●	O	O	●
On-line, context-sensitive help	●	●	O	●	●	●	●
Rated transfer speed (bps)	CPU-dependent	115,200	115,200	115,200	200,000	115,200	115,200
Transfer speed is variable	●	●	O	O	O	O	O
File selection							
By date	●	●	●	●	●	●	●
By time	O	●	●	O	●	●	●
By wildcard	●	●	●	●	●	●	●
PORTS SUPPORTED							
COM 1	O	●	●	●	●	●	●
COM 2	O	●	●	●	●	●	●
COM 3	O	●	O	O	●	●	O
COM 4	O	●	O	O	●	●	O
LPT 1	●	●	O	●	●	●	O
LPT 2	●	●	O	●	●	●	O

█ —Editor's Choice   ● —Yes   O —No

![PC Magazine logo] **Performance Tests:
File Transfer Software**

In general, parallel programs (or parallel versions of programs) were much faster than the serial packages. Of the two programs tested in serial mode, *Rapid Relay Easy* was slightly faster than *Lap-Link Plus*. Some of the parallel programs had slower transfer times on the small files because of program overhead, but they became much more efficient when transferring larger files.

Some of the differences among transfer times are related to the different ways the programs handle data. For example, *Fastwire II* uses two sets of three wires, with a seventh wire mediating the transfer. *Paranet Turbo* performs some data compression before transfer and decompresses the files after the transfer is complete.

Relative Times
(*The Brooklyn Bridge* = 100)

PC Labs tested seven data-transfer programs using four different ASCII files. The file sizes were exactly 1,000, 10,000, 100,000, and 1,000,000 bytes.

The testing was performed by sending files from the hard disk of a laptop computer (a Toshiba 1200H) to an 8-MHz IBM PC AT with a 20MB hard disk and 640K RAM. Each program's fastest file-transfer method was used.

Each test file was sent between computers three times, and the times shown are the average of the three trials. Before the second and third trials for each test were run, the files were erased from the target hard disk.

For comparison, we also ran tests on the 1200H and the AT. In those tests, we recorded how long it took to copy each file onto the same drive from which it came.

Performance Times
(Times given in seconds)

	1,000 bytes	10,000 bytes	100,000 bytes	1,000,000 bytes
Lap-Link Plus (serial)	1.13	2.01	11.10	101.92
Rapid Relay Easy (serial)	0.85	1.80	10.67	99.29
Direc-Link (parallel)	0.86	1.86	10.28	94.65
Fastwire II (parallel)	2.77	3.22	8.18	55.50
The Brooklyn Bridge (parallel)	0.83	1.35	5.53	47.74
Paranet Turbo (parallel)	2.24	2.70	6.89	46.94
File Shuttle (parallel)	1.32	1.62	5.55	44.47
* **Toshiba 1200H**	1.09	1.26	3.05	22.72
* **8-MHz IBM PC AT**	0.75	0.98	2.06	15.59

* These products were not reviewed, but we ran tests on them for comparison, as described in the caption.

batch file, but script files include special commands for automatic data transfer and for setting file selection parameters. Included in the command selection is a message command that you can program to stop the execution of the script file, display a message on the screen, and then wait for a key to be pressed before continuing. This could be used to remind you to insert new disks in a floppy disk drive, for example.

Direc-Link is a quality product, distinguished by its simple but comprehensive customization screens and script files. Its quick and easy dual-control setup and file transfer options make it versatile enough to be used by almost anyone.

Fastwire II

The Rupp Brothers' *Fastwire II* is indeed fast. In parallel mode, it comes close to the speed of the fastest file transfer programs that are exclusively for parallel connections. *Fastwire II* sent our 1MB test file from one computer to another in an average of 55 seconds, compared with *File Shuttle*'s record 44 seconds and *Paranet Turbo*'s 47 seconds.

Fastwire II also functions in serial mode, although not as quickly as in parallel. With either the parallel or serial cable, the software sells for $129.95, or you can get the software and both cables for

$159.95. With both cables, it's the most expensive package we tested, but it's also clearly the most flexible. In addition to working with either parallel or serial connections, *Fastwire II* has three very different interfaces and three ways to automate file transfer. Add to that versatility *Fastwire II*'s excellent transfer times, and you get a strong contender.

After you attach the cable of your choice, all you need do is copy all the files

> **All three**
> ***Fastwire II* modes have**
> **a "Fake It"**
> **option, a convenient**
> **way to check**
> **tagging and option**
> **settings.**

on the included diskette to each computer you're going to connect. *Fastwire II* uses a master/slave, local-and-remote computer relationship. You establish the slave computer's role by typing SL. That computer then sits patiently waiting for a connection to be set up. On the active computer, you type FW2 and then select the interface method you want from a menu. From this same opening menu, you can choose a configuration menu to change the program's port, speed, and error-checking configurations.

The split-screen interface is the simplest to use. You can copy either single or tagged files as well as whole subdirectories. You can sort files by name, extension, size, and date. You can also program *Fastwire II* to send only new files or those modified after a specified date and to prompt you for confirmation before sending. An interesting command common to all three *Fastwire II* modes is the "Fake It" option, in which the program doesn't

really copy any files but does tell you what files it would have sent with the current program settings. It's a convenient way to check your tagging and option settings.

Fastwire II's form mode lets you fill in several on-screen fields to specify a set of criteria for file copying. You can specify transmission direction, remote and local drives and directories, date comparisons and cutoffs, selection and exclusion lists, and whether or not to prompt for each file or to run the Fake It routine first. You can save a filled-in form by name and then call it up from a list of forms that appear on the left of the screen. This makes this mode especially useful for those who have one or more regular transfer sequences.

Fastwire II's command interface looks a lot like DOS, except for a simple screen header and footers that tell you the current program status. While in the command mode, you can issue *Fastwire II* commands to transfer files, as well as execute DOS commands and run programs. You can also use the command mode to execute the *Fastwire II* forms you set up in form mode. Automatic data transfer can also be accomplished via DOS batch files and scripts in command mode.

Fastwire II is hampered only by its master/slave relationship and a fairly hefty price tag for the complete package with both cables. In all other respects, though, this one comes up a winner.

With Fastwire II's form mode, you fill in a form to specify settings for file transfer. After you save the form in a form list, Fastwire will automatically copy files as directed by the form.

This screen shows File Shuttle in action, sending a 1MB file to another computer. Notice the options screen on the right that displays all current settings.

File Shuttle

GetC Software's *File Shuttle*, Version 4.1, has an interesting array of interfaces; you can use the program in English, French, German, or "space" modes. In space mode, a subdirectory becomes a cargo bay, and other space shuttle terminology is used to describe the operations and features of the program.

While *File Shuttle*'s various language interfaces are interesting, the real story is performance. The $119.95 program, which works via the parallel port, gave us the best large-file transfer times of the seven products we tested. On the million-byte files, *File Shuttle* carried off the speed award.

You don't need a special cable to use *File Shuttle*; it comes with the Rocket Socket, an adapter that plugs into the printer end of a parallel printer cable. As printer cables are usually clipped, rather than screwed in, to the printer, this setup is ideal for anyone who travels with a laptop and doesn't want to waste time unscrewing printer cables from a desktop machine. Linking the two machines together takes only seconds.

File Shuttle can be controlled from either connected computer. You select subdirectories from a treelike directory display and files from on-screen listings. To help you find and organize files, you can sort by name, extension, size, and date. You can select single files, marked files, specific files across directories, or even whole subdirectories. A date-range command lets you select files between specified dates, and a "no-dupes" command

prevents you from transferring files if a like-named file exists anywhere in the target disk's directories.

If you want to make a mirror image of a hard disk quickly, *File Shuttle* has the means to do it. If the hard disk drive is bootable, the manual has all the instructions you need if you have to cope with different DOS versions.

You can automate *File Shuttle* using its macro procedure. Just turn on a keystroke recorder to save all key sequences of very complex file-organization and -transfer activities. In case the macro doesn't work as expected, a macro trace function takes you through the commands slowly to help you locate the source of the error you made in setting it up.

What *File Shuttle* lacks is a remote-computer device control to share drives and peripherals. Other programs do a better job of providing the functionality you need to set up a "mini-network." It is also not as easy to grasp as some of the other programs we tested, although you will get the hang of it quickly enough.

File Shuttle is not the cheapest program we tested, and you probably won't ever need to run the program in French or German. However, its lightning speed and performance options make it a good buy in any language.

New UL 1449 Guide to Surge Protection Provides First Objective Standards

UL 1449: The New Watchdog

Until recently, there was no standard to go by in selecting a surge protector. Consumers had to make choices based on little-understood technical specifications that had nothing to do with the performance of a surge protector.

Then, in 1988, the famed Underwriters Laboratories, Inc. (UL) conducted independent tests of leading surge protectors and developed a new standard called UL 1449. The New UL 1449 Standard objectively measures the amount of voltage that can pass through a surge protector after clamping has occurred.

Power Surges Are Common: Earlier studies by the Institute of Electrical and Electronics Engineers (IEEE) have shown that the average office or household receives approximately 100 power surges or "spikes" each month, many as high as 1,000 volts.

Such surges occur whenever power output is "dirty," or not constant. Common sources of power surges in the AC power supply result from nearby lightning strikes, utility companies changing power loads, on-off switching of inductive motors and self-switching power supplies such as air conditioners, refrigerators and dishwashers. If your electronic equipment remains unprotected, these surges can cause irreparable damage to expensive electronics such as computers, TV's, VCR's, stereos and FAX machines. In computers, they can also cause disruption or total loss of valuable data.

Surge protectors act by "clamping" the moment a surge occurs, thereby controlling the amount of voltage that will pass through to your expensive systems or appliances.

UL 1449 and You: Choosing the Right Surge Protector: UL 1449 is a mandatory test for all surge protector manufacturers desiring the UL 1449 listing. A UL 1449 rating of 400 Volts Peak or less assures consumers that the final voltage going through their equipment is at a safe, clean level. Therefore, a surge protector with a UL 1449 rating of 400 Volts Peak offers superior protection to that of another surge protector with a UL 1449 rating of 500 Volts Peak or more.

Protection Features to Consider When Buying Or Specifying Surge Protectors:
- UL 1449 "Most Protection: Rating of no more than 400 Volts Peak."
- Hot to Neutral, Hot to Ground and Neutral to Ground Protection (which protects all incoming lines to your equipment).
- EMI/RFI Filtering—for protection against many electrical and radio frequency interferences.
- Telephone/FAX/Modem Protection—for protection of today's highly sophisticated electronic equipment which requires use of a standard telephone line.
- Manufacturer's Warranty.
- UL, UL 1449 & CSA Listed.

- UL 497A Listed for Protectors of Communication Circuits.

Personal Features to Consider:
- Power cord—for easy access, installation and comfort.
- Remote Switch—for convenient desktop ON/OFF switching.
- Manual ON/OFF switch—for easy control of up to six individual peripheral devices such as computer, printer, copier, calculator, stereo and FAX machines.
- Positive Operation LED (indicator) lights—for seeing at a glance that surge protection is operating at a safe, clean level.
- Phone/FAX Protection—to protect against equipment breakdown and business downtime.

All Curtis Surge Protectors meet the "Most Protection" rating of 400 Volts Peak or less. The Curtis Command Center Plus, a surge protector that controls and protects up to five electronic components received a UL 1449 rating of 330 Volts Peak, the best rating available.

Curtis products are available at computer, retail and office products stores nationally and in Canada. For further information on surge protectors and Curtis products, send for a FREE BROCHURE: "Surge protection and the New UL 1449 Standard." Write Curtis Manufacturing Company, Inc., 30 Fitzgerald Drive, Jaffrey, NH, 03452 or call 603-532-4132, EXT. 149, without obligation.

MOST PROTECTION | | | | | | | | | | | | | LEAST PROTECTION

330	400	500	600	800	1000	1200	1500	2000	2500	3000	4000	5000	6000	VOLTS PEAK

Underwriters Laboratories has developed this chart to show the maximum voltage that can pass through a surge suppressor after clamping has occurred.

All Curtis Surge Protectors meet the "Most Protection" rating of 400 Volts Peak or less.

EVERYBODY

But they're not all switching to the database management system you might expect.

In a recent industry survey,* two-thirds of the respondents who intended to buy a DBMS did not intend to buy dBASE.

And, perhaps coincidentally, two-thirds of recent R:BASE® buyers have used another DBMS before.

Why are they switching to R:BASE?
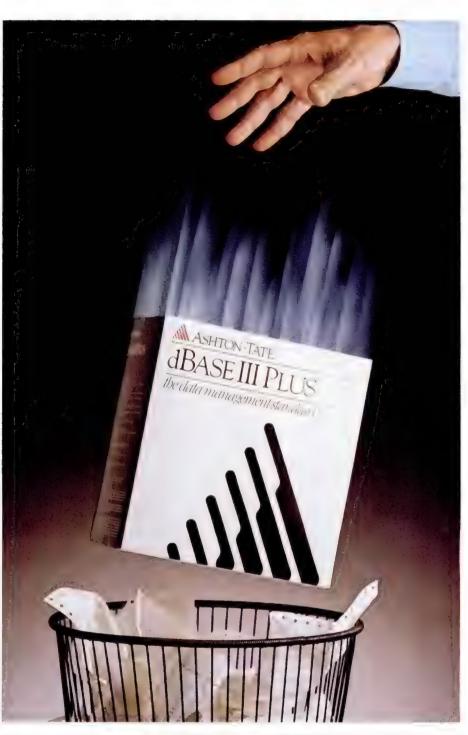
Because nobody really needs a DBMS: they only need what a DBMS can do.

And users find that the friendly facade of other software is fine for questions. But R:BASE has the right answers for their information management needs.

With R:BASE, you can handle all your data management (not just queries) without learning a single command. Our Prompt By Example (PBE) lets you point-and-pick, then R:BASE does the work.

When you find that you're repeating yourself, you automate simply by recording your actions in a macro file.

Or use our application generator to quickly create complete, correct business programs without touching a line of program code.

Data is data, but information is power.

R:BASE gives you that power.
And even impartial judges seem to agree: *PC Magazine, Software Digest, Datapro* and *InfoWorld* all just gave

IS DOING IT.
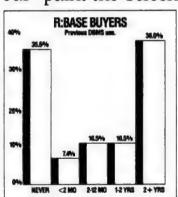
R:BASE their highest marks.

Because to its ease-of-use, R:BASE adds speed, functionality and data integrity in a combination you don't get with dBASE, Paradox, DataEase, Oracle or any of the other contenders.

R:BASE is optimized for speed, with an intermediate code compiler that makes your applications sing. And a true compiler is on its way.

You can use its English-based language in command mode, to modify programs R:BASE writes for you, or to write your own solutions from scratch.

Simple menus, prompts and our "paint-the-screen" techniques make sophisticated screens, forms and reports quick and easy to create. With R:BASE forms, you can view and update data from several tables at the same time. Create computed fields. Include scrolling regions so you can work with all the data from other tables. Add rules for data integrity.

And R:BASE is relational, so your rules stay with the tables—applications can't avoid or change them. And forms can be set up to cascade changes through related tables. So you can trust the information you get.

We also give you an SQL implementation that even novices can use to create simple yet powerful queries.

And networking is free for up to three users. It's also easy, so any single-user application can be run on a multi-user LAN with a single command. And our advanced concurrency control, unlike earlier-generation auto-refresh in other DBMSs, won't bring your network to its knees when you expand with our Six-Pack or Network Unlimited versions.

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R:BASE is the second-largest selling PC DBMS in the world, and it's backed by all the training, service and third-party support you'll ever need.

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Previous DBMS use.

NEVER	<2 MO	2-12 MO	1-2 YRS	2+ YRS
35.9%	7.4%	10.5%	10.5%	36.9%

Lap-Link Plus

You can guess from *Lap-Link Plus*'s name that its purpose is to connect laptop computers to desktop machines. The original *Lap-Link* concentrated on file transfer and file management only. The $139.95 *Lap-Link Plus* package is actually a combination of the *Lap-Link* program and *Lap-Link Plus*, a device-oriented program that lets you control another computer's drives and use its printer. You can still buy *Lap-Link* alone for $129.95, but since the complete package costs only $10 more, it makes sense to invest in *Lap-Link Plus*.

Each program comes with its own manuals, and each has its own installation procedures. Both programs communicate between computers via an included double-headed 9-pin and 25-pin connector serial cable.

Installing *Lap-Link* is easy: just copy the LL.EXE file from the distribution disks to each computer. *Lap-Link Plus*'s installation is a little more complicated and it modifies your CONFIG.SYS file, but you shouldn't run into any difficulties getting it up and running.

In *Lap-Link*, the connected computers display a split screen showing what files are on each. You can control the file trans-

Lap-Link Plus's options menu gives you a convenient way to set copy and directory options, communications parameters, and display colors. You reach this screen directly from the main operating screen, so changing the settings is easy.

fer process from either machine, switching the lead quickly. Convenience features included with *Lap-Link* are a graphic directory display; subdirectory control; file sorting by name, extension, size, and date; and file tagging for batch copying or erasing. A Copy Newer Files feature lets you avoid copying unmodified or older versions of files. The most striking feature of *Lap-Link*, though, is its logical menu structure. Unless you want to get fancy, you can just load the program and run it with little recourse to the manual.

Running *Lap-Link Plus* is also easy, but the program doesn't resemble *Lap-Link* much. The major difference is that *Lap-Link Plus* requires you to set up a master/slave relationship in which one computer is the lead and the other a passive host whose drives and printers are subject to the command of the lead computer. You run the DD.EXE program on the slave computer; this displays a status screen that informs you of the communications parameters being used and tells you when the link with the lead computer is active.

With *Lap-Link Plus* invoked on the lead computer, you can still operate in DOS or in your normal application programs; the difference is that now you have access to the slave computer's disk drives and printer. The drive names on the remote machine are referred to as the next letter after your highest-named drive. For example, if you have a floppy drive A: and a hard drive C: on a lead PC hooked up to a passive-slave desktop computer that also has a floppy drive A: and a hard drive C:, you

would refer to the slave's drives as D: and E: in order to access its files and run its programs from the lead machine. Often this functional joining obviates the need for transferring data files in the first place. The connection also means that all print com-

The most striking feature of *Lap-Link Plus* is its logical menu structure—just load the program and run it.
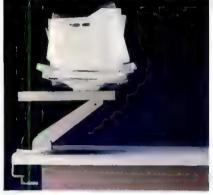
mands issued at the lead PC go directly to a printer hooked up to the desktop slave.
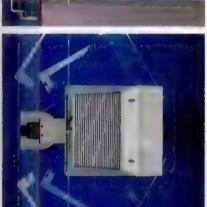
Lap-Link Plus isn't a true networking product, since it can't run both computers at the same time, but the enhanced file and printer sharing it offers make this method of device connection a very attractive alternative, especially in docking situations, where a host desktop lends its drives and printer to a laptop.

In our performance tests, we used *Lap-*

Link's turbo-mode option to use bigger blocks for data transfer. Compared with the other products, especially the parallel port transfer software, *Lap-Link*'s times were average. *Lap-Link* (as well as other programs operating in serial mode) takes about twice as long to transfer 100K and 1MB files as do the parallel port programs.
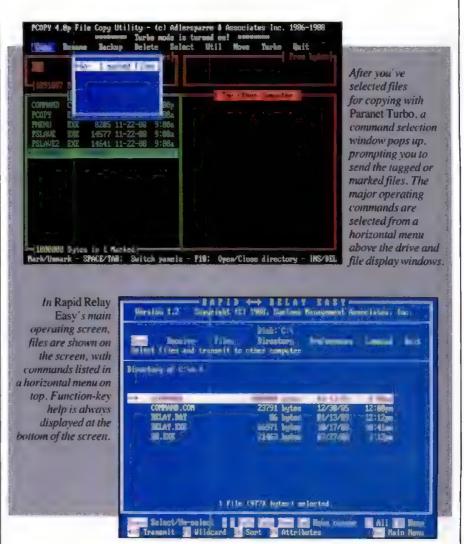
The biggest disappointment with the *Lap-Link Plus* combination of products is the lack of a script language or macro facility. You can automate file transfer with DOS batch files using *Lap-Link Plus*, but we expect more than batch files from a full-priced market leader.

Lap-Link Plus is very simple to use for file transfer operations and for setting up temporary master/slave relationships between computers in order to share drives. It works well and has several convenient features, but it is showing its age a bit. To bring it up to date, it needs improved speed, a macro capability, and better integration of the two very separate products. The way it stands now, it's most useful for laptop users on the move.

Paranet Turbo

Paranet Turbo, Version 4.0, from Nicat Marketing Corp., is both inexpensive and very fast. Fifty-five dollars buys you the software on 3½- and 5¼-inch disks and a

After you've selected files for copying with Paranet Turbo, *a command selection window pops up, prompting you to send the tagged or marked files. The major operating commands are selected from a horizontal menu above the drive and file display windows.*

In Rapid Relay Easy's *main operating screen, files are shown on the screen, with commands listed in a horizontal menu on top. Function-key help is always displayed at the bottom of the screen.*

special parallel cable with two male connectors. Speedwise, *Paranet Turbo* was the second fastest program when it came to transferring our largest test file.
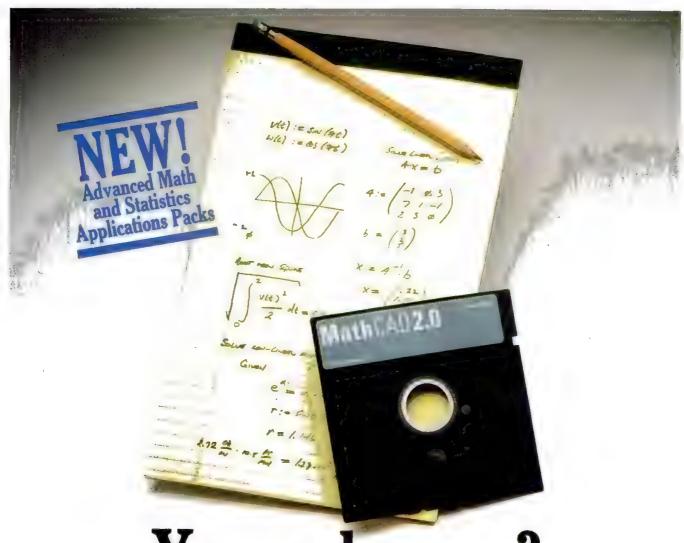
Paranet Turbo connects the two computers in a master/slave relationship. There's no need to change your AUTO-EXEC.BAT or CONFIG.SYS files to install the program. Just run the PSLAVE program on the computer that will receive the files. Next, run a program called PMENU on the source computer and select the Turbo option (in this odd usage of the word, *turbo* refers to working with two computers, while normal mode is for managing files on just one computer).

All operations are controlled through menus; a split screen displays what files are on both computers. You can send files in either direction from the master ma-

chine. You can select to transfer individual files, mark several files, or choose a whole subdirectory and send all marked files and subdirectories at the same time.

In addition to file transfer, *Paranet Turbo* lets you create and remove directories and sort files by name, extension, size, and date. You can browse files that are in ASCII format or run other programs from *Paranet Turbo*. These two capabilities move *Paranet Turbo* beyond the data transfer category and partly into the disk and file management category.

Paranet Turbo has no direct DOS-command mode or automatic file transfer, and you can't control the drives or printers of the remote computer.

Paranet Turbo is speedy; it's also simple to use if you're on the road and need to transfer files quickly to another computer

(assuming its parallel port is accessible). In fact, it gives the best price/performance ratio for this particular need, but if you really need to automate routine transfers of sets of files, you'll probably want to look elsewhere.

Rapid Relay Easy

Systems Management Associates' *Rapid Relay Easy* (formerly known as *Rapid Relay*) is a very good product at a competitive price. For $69.95, you get a double-headed serial cable and both 3½- and 5¼-inch disks. You can choose from two interfaces: an on-screen Lotus-style moving-bar menu, or a simple DOS command line mode.

Rapid Relay Easy doesn't do much besides transfer files, but what it does, it does well. It's a little faster than *Lap-Link Plus*, the other serial-port program we tested.

Setting up *Rapid Relay Easy* could only be simpler if the disks jumped right out of the box and inserted themselves into the PC. If you don't want both modes, just copy the desired interface file to each computer. If you want both the menu-driven and the command line versions, it means copying two files. Since communications port and speed selection are automatic, that's all you have to do before you're set to go.

Both versions of *Rapid Relay Easy* can

be run from either computer. The menu-driven version of *Rapid Relay Easy* uses its moving-bar menus to control all functions. When transferring a file, you must first select Receive on the target computer. Then, on the source PC, you can use a tree-style directory representation to locate the desired subdirectory; once there, mark each file for transfer by tapping the Spacebar as you move down through an on-screen file listing. You can also select all files in a subdirectory if you wish. When you tap

**Setting up
Rapid Relay Easy
could only be
simpler if the disks
jumped right out of
the box and inserted
themselves.**

the Enter key, the program takes off.

In addition to *Rapid Relay Easy*'s fine complement of file selection and control functions, you can sort files by name, extension, size, and date and time. You can also create and delete directories and exit temporarily to run DOS commands.

The command line option lets you specify single filenames for transfer or use wildcards. You can also send specific parameters within a command, such as communications parameters or file attributes. To automate transfer, you can also call script files (text files with an .RR extension), which include a list of DOS commands as well as *Rapid Relay Easy* commands.

The package doesn't let you run programs from the host computer or access its files or printers. Its only other noticeable limitation is its inability to view files.

Rapid Relay Easy is a product whose name fits: it's a wallet-friendly program

that, in fact, relays files rapidly (for a serial port product) and easily. Pure speed demons should look to parallel connection programs, but users who don't need to control devices on another computer will be pleased that *Rapid Relay Easy* costs half the price of some of the products from the big-name competition. ▯

Bruce Brown is a frequent contributor to PC Magazine.

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CIRCLE 173 ON READER SERVICE CARD

DRIVER'S ED

CHOOSING AND INSTALLING A 3½-INCH DRIVE

Laptops have them, PS/2s have them, and with a little do-it-yourself installation, your AT compatible can have a 1.44MB 3½-inch floppy disk drive, too.

THE ABILITY TO SHARE data with other PC users is an essential requirement of the modern workplace. While some companies rely on networks and telecommunications to accomplish this task, ''sneakernet''—transferring data by exchanging floppy disks—is still the most common way to move information from one computer to another.

This seemingly archaic method does have advantages over transmitting information over networks or telephone lines. You don't have to worry about busy file servers, bad phone connections, and unmatched communications protocols. Still, those who trade data on-disk are often confronted with the problem of incompatible floppy disk sizes and formats.

Photograph: James Porto

In the IBM PC/XT/AT/PS/2–compatible world, there are two standard floppy disk sizes—3½ and 5¼ inches—and four standard capacities—360K, 720K, 1.2MB, and 1.44MB. The original PCs and XTs were equipped with 5¼-inch 360K drives, and ATs upped the 5¼-inch ante to 1.2MB. Laptops popularized 3½-inch drives with 720K capacity (a format quickly dying out), while the PS/2 Models 50, 60, 70, and 80 sport 3½-inch 1.44MB drives. If you want the maximum flexibility in sharing data via floppy disks, you

Laptops popularized 3½-inch drives with 720K capacities.

need to be able to read and write all four formats.

Though more than 2 million IBM PS/2s have reportedly been sold to date (and hundreds of thousands of laptops as well), AT-class machines are still the most common in office settings. It seems logical that in offices with both PS/2- and AT-class machines, the most common need is to make the ATs upwardly compatible by adding 3½-inch drives. These reviews focus on 1.44MB 3½-inch drives that can be added to an IBM PC AT or compatible machine.

For format flexibility, there's *COPY-AT2PC*, a $79 utility that converts high-density files so they can be read on low-density drives with no hardware modifications. Contact Microbridge Computers International, 655 Sky Way, #125, San Carlos, CA 94070; (800) 523-8777.

THE DRIVING FORCES We looked at 1.44MB 3½-inch floppy disk drives from three drive manufacturers: Sysgen, Manzana MicroSystems, and Toshiba, as well as one mail-order firm, PC Connection. All the drives we tested format, write, and read both 720K and 1.44MB disks.

ERROR READING DRIVE B:

Will your AT compatible recognize a 1.44MB 3½-inch floppy disk drive without the help of additional software? The answer depends on your machine's BIOS. Most manufacturers now include a BIOS that has been written to recognize the small drive, but if you have an older machine, the BIOS may not have been upgraded before you bought it. Getting the date of the first upgrade from manufacturers can be extremely difficult, but it's worth a try if you plan to install a small drive. A few manufacturers were able to tell us the dates when their BIOSs were first upgraded to accept 3½-inch drives.

AST Research	July 1988
Compaq Deskpro 286, 386	September 1987
Compaq Deskpro 386/25, 386S	June 1988
Compaq Deskpro 386/20e	September 1988
CompuAdd	September 1987
Dell Computer	November 1987
IBM PC AT	Software upgrade

While researching 3½-inch mail-order drives, we discovered some units that are sold without any separate software or controllers: these work in AT-class machines that have BIOS and setup programs to make them automatically recognize 1.44MB 3½-inch drives. Since IBM's set-up program for the AT doesn't know about the 1.44MB format, such a drive won't work in an IBM machine on its own. This can be a problem if the mail-order firm does not sell the software and controller you need—something you should be aware of when placing your order.

It's generally easy to install a floppy disk drive, especially if you're just adding a second one to an AT. Often, most or all of the cables are already there. The main catch is that the computer needs to be able

to find the drive and recognize and work with the formats the drive supports. The drives we've evaluated attack this problem in different ways, some using a combination of special drive interface adapters and others through software alone.

Our tests didn't uncover any startling differences in performance, but speed isn't of the utmost importance here anyway. Today, floppy disks are mostly used as transfer or storage media, not as performance media. The usually small differences in speed are less significant than the drives' ability to read and write in the formats you need.

RULES TO BUY BY The first rule in buying a 3½-inch drive is the same as for any system component, be it hardware or software: know how you want to use it. Do you already have two drives in your AT and would you prefer not to give up either? Then you might want to call Sysgen or Manzana, which have configurations designed especially for that purpose.

If you're adding a 3½-inch drive to most AT compatibles, you'll need nothing other than the bare drive. If the drive is destined for an IBM PC AT or an older compatible, however, you'll need special software or controllers to use the drive with 1.44MB disks (see the sidebar "Error Reading Drive B:"). Check with the manufacturer of your machine to determine what, if anything, you'll need to get to prepare your machine for the new drive. Then go ahead and install it, and you'll be ready for the great data migration from large to small disks in the next few years.

MANZANA MICROSYSTEMS INC.
Manzana Third Internal Plus Manzana Host Powered Plus

Manzana MicroSystems' add-on drives have a lot to offer, and their comprehensive documentation makes them perfect for anyone who is at all timid about adding a floppy disk drive to a system, as well as for users with unusual needs, such as adding two floppy drives to a system that already has two.

Manzana's internal floppy disk drive, the Third Internal Plus, connects to your machine using standard IBM logic, ground, and power cables. The external Host Powered Plus hooks up to a 37-pin plug on the back of a MUX card.

Manzana offers both internal and external 1.44MB 3½-inch drives. If you choose an internal unit to be configured as the second floppy disk drive in an IBM AT, you won't even need an interface card. The Manzana Third Internal Plus drive hooks directly to your machine using the standard IBM logic, ground, and power cables. The included *3Five* software (available with all the Manzana units we reviewed) enables the computer to read the 1.44MB format. At $199.95, this is the least expensive of the fairly pricey Manzana line.

What if your IBM AT already has two floppies—say a 1.2MB and a 360K drive—and you want to keep both of them? If you have an empty drive bay with an unused power lead from your power supply, you can opt for a $289.95 outfit that comes with the same drive and software as the Internal Plus but also includes Manzana's MUX Adapter card—a multiplexer with its own circuitry that lets you control an additional internal and external drive in your system.

If you have a special need for lots of floppy drives, you can use multiple MUX cards for as many drives as your computer's slots, drive bays, and DOS can handle (theoretically, up to a total of 16 drives).

Using a MUX adapter card adds an extra step to the installation process. Before you hook up the drive, you must first slide the MUX card into an interface slot and then attach two cables (the documentation is so clear that it's hard to attach these incorrectly) to the AT's floppy/hard disk controller.

If you don't have a free drive bay for an internal floppy drive in your AT, you're a prime candidate for Manzana's external unit, the $374.95 Host Powered Plus. This unit gets its power from the computer,

drawing an average of 4 watts. As with the Third Internal Plus, you must first install the MUX card in an empty slot and use the cables to hook it to the computer's drive controller. Then you simply plug the combination logic-and-power cable from the external drive to a 37-pin plug on the back of the MUX card.

Manzana also sells an external unit for XTs, which we did not test. The High Density External System comes with a High Density Controller card to enable XTs to work with 1.44MB drives and

The two Manzana drives performed well in our speed testing.
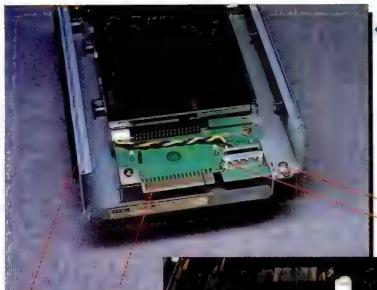
speed up the XT floppy drive data-transfer rate. At $384.95, it is the highest-priced Manzana single-drive addition.

The two Manzana drives tested performed well in our File and Disk Access speed tests. While they were a little slower than the competition in our large-record file access test, they speeded up when it came to the small-record test. Again, it's important to note that the performance question depends not on small gradients of speed, but on doing the job consistently in the proper format.

Manzana is to be complimented on the documentation for its various systems. There are separate manuals for the drives, the adapter card, and the software. In each case, the manuals include all you need to know and probably more, as well as explanatory graphics and a well-organized table of contents.

The only drawback to the Manzana drives is that they are rather high-priced for the user who just needs to add a second drive to an AT-class machine. If your needs are more complex, however, Manzana MicroSystems' drives and components can meet most any demand.

Where the Wires Go:
Installing Your Own Drive

After installation you'll be concerned only with the front of the drive, but before you install it, look at the back. Be sure you identify the three different cable connectors: a broad **gold-lead logic connector** (with a split that's keyed to the cable plug so you can't attach it incorrectly); a **white female power lead plug;** and a single, narrow piece of **metal** held down by a screw for the **ground.** Also notice the **side rails** on the drive chassis; the rails slide into the drive bay to position the drive correctly.

Metal ground

White female power lead plug

Side rails   **Gold-lead logic connector**

Be sure you turn off the power to the computer; for safety's sake, you should also detach all cables from the back of the machine. After you remove the computer's outer case, the next step is to unscrew the plate blocking the front of the drive bay. On the IBM PC AT, this gray plate is attached to a lower, horizontal black piece.

Gray logic cable

Four-wire power lead
Single-wire grounding cable

Before you slide the drive into the drive bay, locate the required cables (all standard with your computer if you're adding a second floppy disk drive to an IBM PC AT) and match them to their respective plugs. Here, from left to right, are the flat **gray logic cable,** the **four-wire power lead,** and the **single-wire grounding cable.**

This photo shows the drive pushed in most of the way under the top drive (**drive A:**) with the cables connected properly. As you'll find out if you add a drive this way, you must loosen the restraining clips on the top drive and pull it forward a bit in order to attach the cables to the lower drive.

Drive A:

Once all of the cables are attached and folded and tucked neatly so everything will fit, push the drive all the way in. A metal stop at the back of the drive bay prevents you from pushing it in too far.

With the drive connected and in place, tighten the restraining clips. All that's left is to put the computer's case back on, plug the exterior cables back in, and turn on the PC. The rest of the setup consists of going through the software steps necessary to make your machine recognize and address the new drive.

The PC Connection TEAC drive is a good choice if you want to add a second drive to your system. Included are the side rails you need to install the drive in an AT, Bastech driver software, and a concise installation instruction sheet.

PC CONNECTION
PC Connection 3½-inch Internal Drive

If you simply want to add or replace a B: drive in your AT, a mail-order floppy disk drive is probably your most economical option. PC Connection, a company that has been a major force in legitimizing the PC mail-order business, offers a floppy-drive-and-software combination that gives the best price/performance value of the units we tested.

PC Connection sells a $119 TEAC 1.44MB 3½-inch floppy disk drive system that includes _Bastech_ driver software, side rails to install the drive in an AT, and a surprisingly complete one-page instruction sheet for installation. The company also provides toll-free technical support.

The TEAC drive is such a standard unit that all you have to do to get it in the AT is attach the side rails. The same drive and software (minus the rails) are sold for XTs, although you'll need a special drive controller to work at 1.44MB and at the proper speed. Because the package from PC Connection was the most generic of those we looked at, this drive was used for the photographs in our installation demonstration.

Once the rails are attached, the drive is in place, and the drive controller, power, and grounding cables are plugged in, you run the _Bastech_ software. If you have an

AT compatible with a BIOS that supports 1.44MB drives, you don't even have to use the software, but the IBM AT we used did need it.

The _Bastech_ software requires you first to use your computer's setup program to identify the newly installed drive B: as either a 360K or a 1.2MB 5¼-inch drive, not as a 720K 3½-inch drive. Running the program also changes your CONFIG.SYS file so that it recognizes the new floppy disk as drive D: (assuming you have a single hard disk named C:; otherwise the next available drive letter is used).

Next, the DOS ASSIGN command is used to tell the computer to call drive D:

drive B:. This may seem a bit strange to novices, and some more-knowledgeable people may be nervous about using the ASSIGN command, but the bottom line is that you're using DOS's capability to set up additional device drivers and then reassign the drive name. It works perfectly well. The only reported problems are with some Tandon computers, and that may simply be because of a missing or incom-

You'll get completely acceptable if not earth-shattering performance from the PC Connection floppy disk drive.

patible MS-DOS ASSIGN command.

Special programs are included on the _Bastech_ diskette to run FORMAT, DISK-COPY, and DISKCOMP commands for disks in the 3½-inch drive only. In most cases, you can refer to the new drive as either drive B: or drive D:. The only time you must call the 3½-inch drive by its real name, D:, is when using the DOS CHK-DSK command, which ignores assigned drive names.

The only aggravation with the _Bastech_ software is its copy protection via a key method: a command called MOVEKEY installs the software on the hard disk. Five installation keys are available, in case you accidentally erase or damage the file on the hard disk. Although you can uninstall a key and move it back to the floppy disk, the whole business is irritating.

In terms of performance, you'll get completely acceptable if not earth-shattering results; the PC Connection TEAC/_Bastech_ combination scored in the middle on all File and Disk Access speed tests. Un-

less you have a Tandon computer or really can't abide Bastech's copy-protection scheme, the low price and steady performance of this unit make it the best deal for adding a second drive to your system.

SYSGEN INC.
Sysgen Bridge-File 3.5 Internal System
Sysgen Bridge-File 3.5 External System

Sysgen is one of the classiest acts in the add-on drive business. The company's drives, adapters, controller cards, powerful software, and excellent documentation combine to give you great control over your add-on floppy disk drive setup. The scope of our evaluations hardly touched on the extensive capabilities of the Sysgen product line, but the company's drives and accessories can meet almost any need.

We tested the $250 Sysgen Bridge-File 3.5 Internal System and the $325 Sysgen

The Sysgen floppy disk drives have extraordinary flexibility.

Bridge-File 3.5 External System. Each drive formats, writes, and reads both 720K and 1.44MB disks.

What makes the Sysgen units special is their extraordinary flexibility. Though it would be somewhat extravagant, you can daisy-chain up to 16 Sysgen drives off a single computer system.

On a more practical level, you can install the Bridge-File 3½-inch Internal or External System drives, along with Sysgen's 42MB tape backup unit and two 5¼-inch drives, in a computer that already has one or more hard disks. That's impressive.

Our tests, which consisted of installing the Bridge-File Internal and External 3.5 Systems as 1.44MB second floppy drives in an IBM PC AT, went smoothly. While the internal card can install as the second floppy drive in an AT without an adapter card, it will format only to 720K. To get the 1.44MB format on the internal drive, you need Sysgen's AT adapter card. The company makes separate adapter cards for IBM PS/2 Models 30, 30/286, 50, and 70; a single card for Models 60 and 80; and a

3½-inch Disk Drives: Summary of Features
(Products listed in ascending price order)

All of the 3½-inch disk drives we reviewed are intended for 1.44MB disks, but they also allow you to format a 720K disk using the DOS command /N:9/T:80. None of them have controller electronics on the drive, nor do they provide disk caching. Other features are compared in the table.

	PC Connection 3½-Inch Internal Drive $119.00	Toshiba ND 356S/T $172.00	Manzana Third Internal Plus $199.95	Sysgen Bridge-File 3.5 Internal System $250.00	Sysgen Bridge-File 3.5 External System $325.00	Manzana Host Powered Plus $374.95
PLATFORM						
IBM PC and compatibles	O	●	●	●	●	●
IBM PC-XT and compatibles	O	●	●	●	●	●
IBM PC AT and compatibles	●	●	●	●	●	●
Compaq Deskpro 386/20 and compatibles	●	O	●	O	●	●
PHYSICAL CHARACTERISTICS						
Drive type	Internal	Internal	Internal	Internal	External	External
Dimensions (HWD, inches)	1.75 x 5.9 x 8.25	1 x 4 x 6	1.75 x 5.9 x 8.25	1.6 x 6.2 x 7.9	1.63 x 5.75 x 8	1.75 x 4.25 x 7.75
Weight (lbs.)	1.93	0.85	1.80	1.89	4.0	2.08
Activity indicator	On-screen	On the drive	On the drive	On the drive	On the drive	On the drive
CONTROLLER INTERFACE						
Compatible with standard IBM floppy/hard disk controller card (Western Digital WAS-2)	●	●	O	●	●	O
Controller card provided	O	O	●	●	●	●

▪—Editor's Choice   ●—Yes   O—No

DOWNSHIFTING YOUR DRIVES

These days, floppy disk users have a choice of disk capacities. In addition to handling the original and ubiquitous 360K 5¼-inch floppy disks, you can format double-sided, high-density 5¼-inch disks to a capacity of 1.2MB. Users of 3½-inch floppy disks can choose from capacities of 720K, 1.2MB, and 1.44MB. What does it all mean? How can you format lower-capacity disks in higher-capacity drives?

Several variables exist. One is the actual capacity of the floppy disk drive you're formatting with. Another is the media, or diskette size and type: 5¼- or 3½-inch, double-density or high-density. A third is the operating system version you use. Here are the DOS 3.3 format commands you'll need to know to do two special floppy-disk formats:

FORMAT /4   Use this command to format a 360K single- or double-sided disk in a 1.2MB-capacity 5¼-inch floppy drive. Don't count on using disks formatted this way in a single- or double-sided drive; they're not reliable.

FORMAT /N:9 /T:80   Use this command to format a 720K diskette in a 1.44MB 3½-inch drive. The /N and /T switches refer to the tracks per sector and the numbers of tracks, respectively.

That's it. So if you have a 360K 5¼-inch floppy disk drive, you can use it to format only single-sided or double-sided disks up to 360K. With a 720K 3½-inch disk drive, you're stuck with 720K double-sided disks. You can use the format command above on your 1.2MB 5¼-inch drive to format 360K diskettes as well as high-capacity 1.2MB disks. And with your 1.44MB 3½-inch disk drive you can format 720K double-sided disks or 1.44MB double-sided disks.
—**Pamela Milland**

Pamela Milland is a PC Labs project leader.

Both the Sysgen Bridge-File 3.5 Internal System and Bridge-File 3.5 External System format, read, and write 720K and 1.44MB disks, giving them great flexibility. With Sysgen's software you can refer directly to the drive as B:.

card for AT compatibles and 80386-based PCs. Each card is available for $70.

Placing the AT adapter card in a slot close to the AT's drive controller card is the first step when installing the Bridge-File 3.5 Internal System in 1.44MB format. Then you follow simple instructions to attach an included cable and one end of the AT's floppy disk controller cable to the adapter card.

Next, you slide the drive into the open drive bay and attach the AT's drive controller, along with power and grounding cables. You run the AT setup program to declare the existence of a new high-capacity drive. Finally you reboot and then run the simple Sysgen installation software so that the computer will know the proper drive format.

Unlike the *Bastech* software, Sysgen's software lets you refer to the drive directly as drive B: without using DOS's ASSIGN command. This method is preferable because some applications ignore ASSIGNed drives. It also means you don't have to use any special commands to perform format or copy operations once the drive is running.

The Sysgen Bridge-File 3.5 External System differs from the internal drive in that you must attach the external unit to the 37-pin connector on the back of the AT adapter card. An interesting alternative is to buy Sysgen's Omni-Bridge card in-

stead. The Omni-Bridge, which costs $95, lets you control up to four devices—two internal and two external. The drives hanging off the Omni-Bridge card can be any combination of 3½-inch and 5¼-inch formats and can also include Sysgen's $695 42MB tape drive.

The Sysgen drives lagged a little behind the others in our small-record DOS File Access test but outperformed the competition in the same test with large records.

Paradise.
It's also the best selling PC graphics card in the world.

While the Internal drive scored about average on the Disk Access benchmark test, the external drive was somewhat below the norm. Small variations in performance times don't matter much in real-world applications, however.

Like the Manzana units, the Sysgen drives probably cost too much if you just want to add a second floppy unit to your AT. But if you want to add a third, fifth, or even seventh drive, or two 3½-inch drives and a tape backup unit, Sysgen deserves your attention.

TOSHIBA AMERICA INC.
Toshiba ND 356S/T

The need to swap disks with laptop computers was the driving force behind making 3½-inch drives available for desktop systems. Since Toshiba America was the first to manufacture a laptop that the market took seriously, it makes sense that Toshiba is also one of the major vendors of 3½-inch add-in floppy disk drives for installation in AT-class machines.

The $142 Toshiba ND 356S/T is the most compact of the drives we reviewed. Measuring just 1 inch high by 4 inches wide by 6 inches deep, the Toshiba drive fits in almost any computer case. Some of the vendor literature even talks of strapping two or three together to put in a full-height drive bay. The unit, which weighs less than a pound, is also a very quiet performer.

The ND 356S/T can be formatted to either 720K or 1.44MB capacity, and the same unit can be installed in both portables and desktop computers. Since laptops use

Benchmark Tests: 3½-inch Disk Drives

PC LABS

PC Labs tested six 1.44MB 3½-inch floppy disk drives and used the Toshiba ND 356S/T as a standard for comparing the results. The Toshiba was fastest on the DOS File Access test for small records. The Sysgen Bridge-File 3.5 Internal System was slowest on this test because of the Sysgen software, which must simulate DOS interrupt 13 (DOS requires its own system BIOS calls with internal drives). Yet the range of times on this test was narrow, with the slowest score within 7 percent of the fastest.
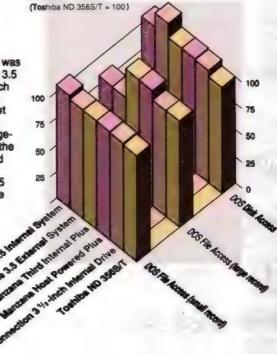
Sysgen's internal and external systems were by far the fastest with the large-record DOS File Access test. These drives chopped more than 20 percent off the timings of the slowest drives, Manzana's Third Internal Plus and Host Powered Plus.

The drive with the slowest DOS Disk Access time, Sysgen's Bridge-File 3.5 External System, uses DOS interrupt 25, which reads sectors regardless of the drive format. The overhead that DOS required to read the external drive, determining format as well as read sectors, caused the slowdown in performance.

The **DOS File Access** benchmark test measures the throughput rate of the disk being tested. In this case, throughput times are measured in terms of how long the disk takes to perform common DOS file-management functions. Five tasks—file creation, sequential file write, sequential file read, random file write, and random file read—are timed and the results summed.

The test is carried out for two different types of files—small-record files and large-record files—that are used by common PC applications. Files created using small records are typically used by database management programs, and large records are typically used for word processing and spreadsheet files. Loading a DOS program is also simulated by the large-record test.

The **DOS Disk Access** benchmark test measures the time it takes to do a random sector read using DOS. DOS buffers are set at 3 and the interleave factor is left at the drive's default setting. This test adds DOS's overhead to the BIOS and hardware times. The test program performs the sector read 1,000 times within the DOS disk partition. The average result is shown in milliseconds.

Relative Times
(Toshiba ND 356S/T = 100)
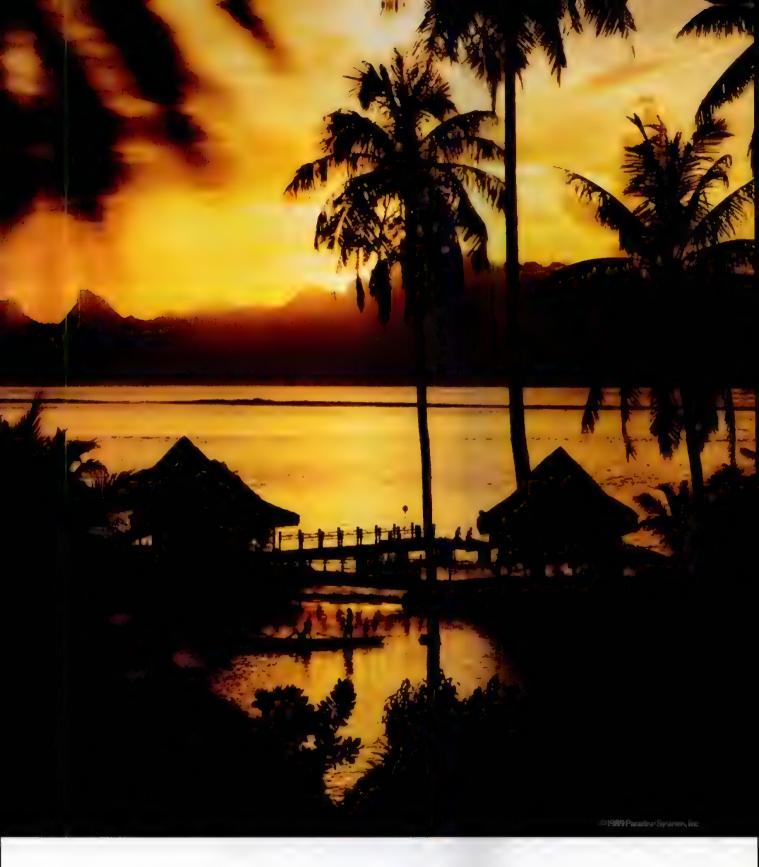
Performance Times
(Times given in seconds except where noted)

	DOS File Access (small record)	DOS File Access (large record)	DOS Disk Access (milliseconds)
Sysgen Bridge-File 3.5 Internal System	820.46	136.54	208.35
Sysgen Bridge-File 3.5 External System	791.18	135.98	234.16
Manzana Third Internal Plus	787.23	179.76	208.30
Manzana Host Powered Plus	785.07	179.42	208.46
PC Connection 3½-inch Internal Drive	779.96	164.47	206.52
Toshiba ND 356S/T	769.65	164.52	195.72

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Paradise.
It's also the PC graphics card used by more computer manufacturers than any other.

Not only is the Toshiba ND 356S/T capable of formatting to either 720K or 1.44MB capacity, but it is also the smallest of the drives evaluated. Because of its compact size, you can install it in either a portable or desktop computer.

a different kind of power connector, a different drive-controller plug, and a different mounting system than desktop PCs use, you must be sure to get the right accessories for your particular machine when you order a Toshiba drive.

If you are going to install the ND 356S/T in a desktop unit, get the Universal Installation Kit. The kit, which adds only $15 to the price of the drive, comes with a desktop-style DC power cable adapter, both gray and black faceplates (in proper desktop width), side rails to fit AT drive bays, and a mounting bracket with the proper connector for desktop floppy-drive-controller cables. No cable is needed if the unit is to function as drive A: or B: in an AT compatible.

The Universal Installation Kit also comes with a helpful 20-page manual. The manual's only fault is that it covers a wide range of desktop machines; there's inevitably information you don't need, which can make a simple process seem tougher than it really is.

To install the Toshiba ND 356S/T, put on the properly colored faceplate, attach the power-cable adapter, set the drive in the bracket, and check one switch on the back of the bracket to make sure it's set to work in an AT. Then attach a set of rails to the sides of the drive bracket and slide the whole unit into the drive bay. Next you attach the computer's drive cable, power cable, and grounding wire to the drive and push it in.

If, as is the case with the IBM PC AT, your computer's BIOS and setup program don't know about 1.44MB 3½-inch drives, you should order the driver software from your Toshiba dealer. Toshiba sells the same Bastech floppy-drive utility software package that we discussed in our review of the PC Connection 3½-inch Internal Drive.

The Toshiba drive works well. In our testing, it performed slightly better than average on the File and Disk Access speed tests.

FACT FILE

Toshiba ND 356S/T
Toshiba America Inc.
Disk Products Division
9740 Irvine Blvd.
Irvine, CA 92718
(714) 583-3108
List Price: $142; Universal Installation Kit, $15; driver software, $15.
In Short: The Toshiba ND 356S/T is small and quiet and works well. In return for the higher-than-mail-order price, you get the security of buying from one of the largest vendors of 3½-inch drives.

EDITOR'S CHOICE

• PC Connection 3½-inch Internal Drive

Floppy disk drives don't have a lot of mystery. Any performance differences are usually slight and not of prime importance in choosing a unit. Just make sure you specify the 1.44MB format. Unlike 5¼-inch drives, which aren't too amenable to disk densities other than their own, high-density 3½-inch drives have no trouble writing to 720K floppy disks, which can then be read reliably in 720K drives.

When it comes to adding a 1.44MB 3½-inch floppy disk drive to an IBM PC AT, the crucial factors are price and vendor reliability. In that case, the clear winner is the PC Connection combination of a TEAC internal drive with Bastech driver software. At $119, it is the least expensive of the units we reviewed, and PC Connection has an exceptional reputation for customer service.

If you want to add a 3½-inch unit as a third or fourth floppy drive, you should look to the Sysgen and Manzana products. Both companies offer full product lines with special-purpose adapters and controllers, internal and external drives, powerful software, and terrific documentation.

When you add up the cost of the drive, Universal Installation Kit, and the Bastech utility software (the price of the latter is fixed by the dealer but averages $15), the Toshiba ND 356S/T runs about $172. That's certainly not the least you can pay for an add-on drive setup, but your money does get you a solid performer and the security of buying from one of the largest 3½-inch-drive vendors.

Bruce Brown is a frequent contributor to PC Magazine.

PC BRAND 286/12 $949

PC BRAND 286/20 $1300

Ideal Novell Server!

12 MHz Clock, Zero Wait Operation,
Norton SI 15.3 •Landmark™ Speed 16MHz
512K, 1.2MB or 1.44MB Drive, 101- Keyboard

Standard System Features:
- 80286 Processor Operating at 12MHz with Zero Wait States delivering 16MHz Effective Throughput
- 512K RAM expandable to 4MB on the System board using 256K and/or 1MB 100ns RAM chips
- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
- 1:1 Interleaving Dual Hard Drive/Floppy Drive Controller
- Enhanced 101-key AT Style Keyboard
- High Capacity System Power supply
- Real Time Clock/Calendar with 5 Year Battery
- 80287 Co-Processor Support
- Industry Standard BIOS with full MS/DOS, OS/2, XENIX, NOVELL, 3COM and PCNET compatibility
- Built-in System Board LIM EMS hardware drivers
- User configurable I/O timing permitting compatible operation with older peripherals or faster I/O for newer devices
- 8 Slot motherboard design (6 16Bit & 2 8Bit)
- Small foot print case with 5 Disk Drive bays

Options:
- Full size 5 drive case • Factory Installed RAM Upgrades
- Custom configurations w/Name Brand peripherals of your choice
- Compaq® Style LCD Portable • Tower Case

Standard Pre-Built Configurations:

286/12 With 512K, Hard Disk Drive, Monitor & Video Card				
Drives / Video	20MB 1:1 MFM	40MB-40MS 1:1 MFM	40MB-28MS 1:1 MFM	80MB-28MS 1:1 MFM
Mono	$1335	$1439	$1548	$1679
EGA	$1729	$1833	$1942	$2073
VGA	$1900	$2004	$2113	$2244

20 MHz Clock, Zero Wait Operation
Norton SI 20.4 •Landmark™ Speed 25.9MHz
512K, 1.2MB or 1.44MB Drive, 101-Keyboard

Standard System Features:
- 80286 Processor Operating at 20MHz with Zero Wait States in interleave mode delivering 26MHz Effective Throughput
- 512K RAM expandable to 8MB on the System board using 256K and/or 1MB 100ns RAM chips (4MB on motherboard and 4MB on optional special interleaving daughter card)
- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
- 1:1 Interleaving Dual Hard Drive/Floppy Drive controller
- Enhanced 101-key AT Style Keyboard
- High Capacity 200 Watt System Power Supply
- Real Time Clock/Calendar with 5 Year Battery
- 80287 Co-Processor Support
- Industry Standard BIOS with full MS/DOS, OS/2, XENIX, NOVELL, 3COM, and PCNET compatibility
- Built-in System Board LIM 4.0 EMS hardware drivers
- User configurable I/O timing permitting compatible operation with older peripherals or faster I/O for newer devices
- 8 Slot motherboard design (6 16Bit & 2 8Bit)
- Medium foot print case with 5 Disk Drive bays

Options:
- 386SX Upgrade • Tower Case • 4MB Interleaving Ram Card
- Custom configurations w/Name Brand peripherals of your choice
- Compaq® Style LCD Portable • Factory Installed RAM Upgrades

Standard Pre-Built Configurations:

286/20 With 512K, Hard Disk Drive, Monitor & Video Card						
Drives / Video	40MB-40MS 1:1 MFM	40MB-28MS 1:1 MFM	80MB-28MS 1:1 MFM	110MB-28MS 1:1 RLL	150-16MS 1:1 ESDI	320-16MS 1:1 ESDI
Mono	$1790	$1899	$2030	$2296	$3000	$3923
EGA	$2184	$2293	$2424	$2690	$3450	$4317
VGA	$2355	$2464	$2595	$2861	$3700	$4488

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To Order Call 1-800-PC BRAND

Shop PC Brand Today.

!!MEMORANDUM!!

!!●To: !!● Sales Staff

!!●From:!!● Market Research Dept.

!!●Re:!! 1990 Projections●

BRIEF ANALYSIS OF FIGURES

theso projections poinʃ upwardς througʰ alʳ :::
uς tn thσ conclusioɛ thaʃ wσ havσ finallʳ stumbleΣ
thaʃ iς immunσ tn seasona∞ saleς fluctuations.
telephonσ researc♦ pinpointς severa∞ aspectς oμ thσ
aʃ havσ turneΣ ouʃ tn bσ particularlʳ attractivσ tn
nipʳ ⊥ detaileΣ reporʃ oɛ thaʳ researc♦ wilʳ ʳ ʳ ʳ ʳ ʳ
thσ firsʃ installmenʃ oμ thσ independenʃ researc♦ wσ

BATTLING BABEL
WORD PROCESSING FORMAT CONVERSION

Any company with more than two computers is a candidate for the modern equivalent of the Tower of Babel. Just when it appears that you have everything in place for a major job, you run smack into the "confusion of tongues" problem that confounded that construction project of Biblical fame. In this case, however, it's not *people* who have a communication problem; it's word processing programs that can't understand each other.

Many word processors have some limited conversion capabilities, but these are often unreliable and parochial. If you need to convert files between two programs and

Preserving your formatting commands as you move among word processors is the forte of these four format-conversion programs.

MEMORANDUM

<ins>To:</ins> Sales Staff

<ins>From:</ins> Market Research Dept.

<ins>Re:</ins> 1990 Projections

BRIEF ANALYSIS OF FIGURES

The fact that these projections point upwards through all
four quarters leads us to the conclusion that we have
finally stumbled onto a product that is immune to seasonal
sales fluctuations.
        Our own telephone research pinpoints several aspects of

Photograph: James Porto

you have neither of them, your own word processor is not likely to be of much help. Some programs take a decidedly dim view of other word processors: *DisplayWrite 4*, for example, will import or export only straight text and DCA (Document Content Architecture), as well as Revisable Form Text (RFT). It completely ignores the existence of any other formats.

TEXT-ONLY APPROACH   Some people have found success by limiting themselves to pure-text-file exchanges between word processing programs. This is fairly safe, since almost every program on the market has a way to save and read a straight ASCII text file—one that has no formatting characters or printer codes buried in the text.

This is a fine approach, since the only problem you're likely to encounter is annoying carriage returns at the end of each line. If they show up, your program may view each line as a separate paragraph and make editing a tedious task. The biggest problem with an ASCII transfer, however, is that you lose all the formatting of the original document. Underlining, bold text, margins, header and footer details, and all other formatting features that were included in the original document disappear.

Some people work around this limitation of text files by using pseudoformatting codes, like inserting BO> at the start of bold text and <BO at the end. After the conversion, they perform search-and-replace operations to insert the correct codes for the target format.

If you think all this sounds like too much work, you're right. Why not just run the file through a conversion utility and have it make the appropriate changes? As you'll see in this evaluation of format converters, the process is not as clear-cut as you might expect. The most important lesson is that you cannot expect perfection from any conversion program: there will always be something left for you to do after it has finished its part of the task.

A DIFFICULT TASK   If you look at different word processing file formats, you can see how difficult the conversion task is. Take a simple matter like boldface text. In *WordStar*, you put a Ctrl-B at the start of the text that you want boldfaced and then

File Conversion Software: Summary of Supported Formats

Some format conversion software works only with certain versions of word processing programs. Before you buy, you should contact the manufacturers to make sure that your word processor version is supported by the translator.

SUPPORTED FORMATS	R-Doc/X	Software Bridge	Word for Word	Word-Link
ASCII	●	●	●	●
CEOwrite	N/A	●	N/A	N/A
DCA FFT	N/A	Output only	N/A	N/A
DCA RFT	●	●	●	●
DEC WPS PLUS	N/A	●	N/A	N/A
DisplayWrite	●	N/A	N/A	N/A
EBCDIC	N/A	N/A	●	N/A
Enable WP	●	N/A	N/A	N/A
Freestyle	●	N/A	N/A	N/A
Leading Edge WP	Input only	N/A	N/A	N/A
Lotus Manuscript	●	N/A	N/A	N/A
Microsoft Word	●	●	●	●
Microsoft RTF	N/A	N/A	●	N/A
MultiMate	●	●	●	●
Navy DIF	N/A	Input only	●	N/A
NewWord	●	N/A	N/A	N/A
OfficeWriter	●	N/A	●	●
Palantir	●	N/A	N/A	N/A
PC-Write	●	N/A	N/A	N/A
PeachText 5000	●	N/A	N/A	N/A
PFS:First Choice	●	N/A	●	N/A
PFS:Professional Write	●	N/A	●	●
PFS:Write	●	N/A	●	N/A
Pmate	●	N/A	N/A	N/A
Samna Word	N/A	●	N/A	N/A
Sprint	N/A	●	N/A	N/A
Volkswriter	●	●	●	N/A
Wang PC (IWP)	N/A	●	N/A	N/A
WordMarc	●	●	N/A	N/A
WordPerfect	●	●	●	●
WordStar	●	●	●	●
Writing Assistant	●	N/A	●	N/A
XyWrite	●	N/A	●	N/A

●—Input and output   N/A—Not applicable: not supported by the conversion software

another Ctrl-B at the end to stop it. That's pretty straightforward: all the program has to do is insert a "start bold" at the first Ctrl-B and an "end bold" at the next one. But all sorts of things can happen between the two, such as underlining, page breaks, and page-format changes. In other programs, the codes are more complex. In *Xy-Write* «MDBO» means start of bold, but «MDNM» simply means return to normal type. It turns off the bold, but also turns off underlining, superscript, subscript, and other enhancements.

Conversion programs must be extremely sophisticated in their ability to identify patterns in the document file and make the appropriate changes. When you consider how often these patterns are nested (using a running header with different margins and boldface text, for example), you begin to see how challenging the job can become.

There are some formatting commands that no conversion program can handle. For example, many word processors now support laser printers and a host of different proportional fonts. These fonts are typically controlled by the printer driver you have loaded in the program when you print. There is no way that a conversion program will know what font your document means when it says "Font 1" or "Font 2," so don't expect special font features to convert.

People who don't do their own conversions frequently turn to format-conversion services, dozens of which advertise in this and other computer magazines. These services, each of which specializes in slightly different formats, are most cost effective for large-volume jobs or for truly bizarre translation needs. Some services also charge setup fees on top of the conversion charges. The everyday user will probably find the programs reviewed here to be a less-expensive solution.

To explore the issue of word processing file conversion, we tested four programs: *R-Doc/X, Software Bridge, Word for Word,* and *Word-Link.* All four are priced around $150. They were chosen from among dozens to illustrate the range of performance you can expect in this price range. There are many other conversion programs, some more fluent than others, priced from under $100 to over $1,000.

The testing procedure, which focused on the accuracy of conversion, was based on a two-page document designed to test translation of common formatting features. We also timed the conversion process. As you'll see, the most accurate program also had the slowest conversion times, which leads to the conclusion that, in this class of software, speed is not the most important selection criterion.

R-Doc/X

Some software publishers go all out with their programs, loading them up with flashy menus and space-age packaging. In contrast to this glitzy approach, Advanced Computer Innovations takes a more modest track with its conversion program, *R-Doc/X.*

The $149 program comes complete on a single disk, which you install simply by copying to a subdirectory on your hard disk. (It's so small you can even run it on a floppy disk machine with 360K drives.) Before you can run it, you need to install ANSI.SYS in your CONFIG.SYS file on your boot disk, but that's a small task, especially since a sample CONFIG.SYS file comes on disk for your use.

The single disk comes with all the different format overlays. There are 33 source formats and 32 destination formats. These include nearly every popular word processing format and a few lesser-known

ones, as well. Need to handle files to or from *WordMarc Composer, Lotus Manuscript,* or *PeachText 5000? R-Doc/X* has you covered. It even handles *PC-Write* files, with one format for versions before 2.6 and another for 2.6 and later.

You can specify drives and subdirectories when you name the source and destination files. *R-Doc/X* will accept either the backslash (\) or regular slash (/) in path names. You can also use the standard DOS wildcard characters (both ? and *) to convert batches of programs at one time. You can even rename files on the fly, giving them new extensions as they are produced.

The program keeps you informed as the conversion progresses. The screen shows a small graph from 0 to 100, and dots appear as the file is processed. When the conversion is complete, you can enter new source-file specifications or return to the DOS prompt.

R-Doc/X is simple enough to operate, but its modesty detracts from its overall value. To begin with, the documentation is a collection of stapled, typewritten pages. It is thorough and includes lots of examples and detailed explanations about the limitations of different conversions, but it is not easy to use and is organized in the traditional "5.1.1:" section-numbering approach that makes for dry reading. The manual is helped by an extensive index.
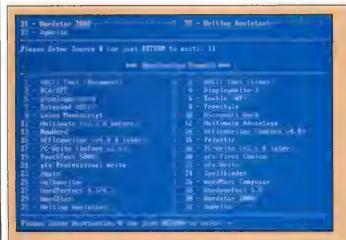
The user interface also needs help. It is archaic at best, a throwback to the CP/M days when computer displays were treated as teletype machines. The first menu is a listing of the source formats that scrolls up on your screen. After you select the source format, the destination-format menu scrolls up, leaving a few lines of the original menu at the top. This is an unattractive approach.

The menus are confusing, as well. First, the destination menu never varies, which means that you can select the same format as the source and destination. That would be more palatable if the options were identically numbered, but they're not. *Microsoft Word* is option 11 on the source menu but number 10 on the destination menu. There is no apparent reason why the options could not be consistently numbered.
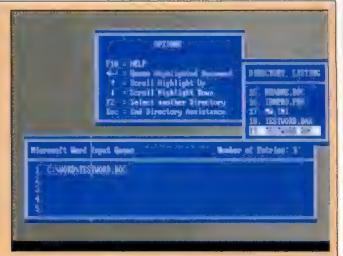
The progress graph is handy but also rather simple, since it is based on a series

The opening menus of R-Doc/X *reveal its aging user interface. Here the first menu has scrolled off the top of the screen, leaving a few lines stranded as the second menu is displayed. Also note the different numbers for the formats at the top and bottom of the screen.*

Software Bridge *will show you a file listing of any subdirectory so that you can select input files. You are not limited to a single directory, and you can even input multiple files. The input file list will scroll to accept more than the five lines shown in this screen.*

of periods that are printed in a line. Installation requires using ANSI.SYS, but only to clear the screen before the graph appears. ANSI.SYS could be used to better advantage for color and improved screen management.

R-Doc/X cannot process a batch of files except by using wildcards; you cannot give it a list of filenames to be processed at one time. The manual does explain how to process files from the DOS prompt, but the only way to do so is to create a text file and use it as a redirected input file. If you have ever tried this, you may have found it to be an unforgiving and difficult approach. The manual doesn't even suggest the benefit of a text editor; it leaves you at the mercy of the ''COPY CON filename'' process.

All of these flaws could be easily overlooked if the program were excellent at its job. Unfortunately, it ended up with the worst average score of the four programs. It had extreme difficulty converting margin formats and frequently dropped the header text entirely.

According to Advanced Computer Innovations, a new version of *R-Doc/X* is in the works and should be available this spring. This revision is slated to have a more modern interface and more thorough conversion of file formats. It will also handle the latest versions of many popular programs, including *WordStar*, Version 5.0,

and will no longer require ANSI.SYS in your configuration file.

Until then, *R-Doc/X* is an antiquated utility that leaves you with almost as much work as a simple ASCII transfer would take. Other programs work better.

Software Bridge

Software Bridge, a $199 file conversion package from Systems Compatibility Corp., comes in a few different flavors. We tested the Combination Package, which is designed to translate to and from 18 different file formats, including ASCII. The company offers another version that supports all of the formats except ASCII, as well as a special version designed to run on LANs.

The program is a snap to install. You simply make a subdirectory and copy the files to it. The Combination Package contains six disks, but the manual shows clearly how to determine which files you can skip if you decide that you don't need all the different formats all the time.

There are no special requirements for your configuration file, except that you should have a statement setting FILES = 20 or some higher number. The manual tells you how to add this line if you need to.

The user interface is logical and helpful. The program is configured so that it

can translate to and from any pair of formats at a given time. You can select either of these pairs from the main menu. (Note that *Software Bridge* can translate only *to* FFT (Final Format Text) and *from* Navy .DIF format.)

If you want to change the active pair, you select the System Setup option. This lists the two active conversion formats on either side of your screen and puts a window in the middle showing the other available formats. The display is intelligent: if you select a format, it disappears from the center list, and the format that it replaced then becomes available in the center.

The System Setup screen opens onto a host of other options. You can customize certain parameters for the different formats and can set up complex character-translation tables and filters. You also have access to on-screen help.

Once you have settled on your translation formats, you pick a direction (from one to the other) and then select the files to be translated. These can come from different directories, and you can call up a directory in a window to highlight the files you want. You can also select multiple files by entering a wildcard for a filename. If your wildcard specification happens to include some files you do not want to translate, it is a simple matter to highlight and delete them before starting the translation.

generation in printers.
ns in the family.

KX-P1180

Resident type-fonts on all 1100 Series printers include draft pica and elite, letter-quality or near-letter-quality Courier, Prestige, Bold PS and Sans Serif. Plus Script on the 1124.

All these resident LQ or NLQ fonts are available in ten different character sizes.

And print speeds go from 38 to 63 cps in letter-quality/near letter quality. And from 160 to 240 cps in draft.

The 1100 Series printers also produce graphics as well as they handle text. Resolution is crisp, clear, precise. With bit image matrixes from 240x216 dpi to 360x360 dpi.

All of these features enhance your ability to create—and be creative.

The EZ Set™ Operator Panel puts features at your fingertips.

1124 printer shown.

The 1100 Series printers were designed for non-software experts.

The EZ-Set™ Operator Panel allows you to make choices simply and quickly—without having to program any software.

The ergonomic design presents you with settings for the features you use most. Fonts, pitch, form length and many more choices can be pre-set on the panel. And the 1124 even has a Macro feature that allows you to easily save and recall all the panel settings for three different formats.

Selectable on the EZ-Set™ Operator Panel:
- Fonts: 4 to 6, depending on model
- Pitch: 4 to 6, depending on model
- Form Length: From 8" to 14"
- Quiet Mode: Cuts printer noise by 50%
- Micro Line Feed: forward and reverse
- Perforation Cut
- Self Test

Plus the protection of a two-year warranty.

The 1100 Series is a family of full-featured 24- and 9-pin printers. Compatible with the rich software libraries supporting both Epson* and IBM** dot matrix printers. And protecting your investment with something you'll find on very few printers out there: a two-year warranty*** on *both* parts and labor, from Panasonic.

That makes them good investments.

From any business perspective.

For more information on the 1100 Series printers or any of our other versatile computer products call:

1-800-PIC-8086.

* Epson is a registered trademark of Seiko Epson Corporation.

** IBM is a registered trademark of International Business Machines Corporation.

*** The complete warranty is available for review at your Panasonic Dealer.

Panasonic
Office Automation

Copiers, Typewriters, Printers, Peripherals and Facsimiles

Match your needs against these:

KX-P1124
24-Pin Printer

Print Speed:
(Characters/second)

	Draft	LQ
Elite	192 cps	63 cps
Pica	160 cps	53 cps

Letter Quality Fonts:
Courier, Prestige, Bold PS,
Sans Serif, Script

Resolution:
Draft—24 x 9
LQ —24 x 30

Bit Image (matrix):
360 x 360 dpi

EZ-Set Operator Panel:
Primary functions include:

Font	Lines Per Inch
Pitch	Quiet Mode
Form Length	Perforation Cut
Paper Loading	Paper Parking
3 Macro Settings	Margin Settings
Micro Line Feed	Default Setting

Tractor Type:
Push/pull, swivel mount, flat belt

Paper Feed:

Path	Method
Top	Cut Sheet Feeder (opt)
Rear	Push Tractor
Bottom	Pull Tractor
Front	Friction or Pull Tractor

Emulations:
Epson LQ-2500; IBM Proprinter X24

Buffer:
6K (std); 32K (opt)

Noise Level (LQ Mode):
56 dbA (Standard);
53 dbA (Quiet Mode)

Dimensions:
16.9 (w) x 14.1 (d) x 5.6 (h) inches
18.7 lbs

Options and Accessories:
Cut Sheet Feeder (KX-P36)
RS-232C Serial Interface (KX-P19)
32K Expansion Buffer Chip (KX-P43)
Re-Inking Fabric Ribbon (KX-P145)

KX-P1191
9-Pin Printer

Print Speed:
(Characters/second)

	Draft	NLQ
Elite	240 cps	48 cps
Pica	200 cps	40 cps

Near Letter Quality Fonts:
Courier, Prestige, Bold PS,
Sans Serif

Resolution:
Draft—9 x 9
NLQ (Sans Serif)—18 x 9
NLQ (All others) —18 x 18

Bit Image (matrix):
240 x 216 dpi

EZ-Set Operator Panel:
Primary functions include:

Font	Bold Mode
Pitch	Quiet Mode
Form Length	Perforation Cut
Micro Line Feed	Italic Mode
Line Feed	Form Feed
Lines Per Inch	Margin Settings

Tractor Type:
Push or pull pinwheel

Paper Feed:

Path	Method
Top	Friction/Cut Sheet Feeder (opt)
Rear	Push Tractor
Bottom	Pull Tractor

Emulations:
Epson FX-86e; IBM Proprinter II

Buffer:
6K (std); 32K (opt)

Noise Level:
55 dbA (Standard);
52 dbA (Quiet Mode)

Dimensions:
16.7 (w) x 13.4 (d) x 5.2 (h) inches
15.7 lbs

Options and Accessories:
Cut Sheet Feeder (KX-P37)
RS-232C Serial Interface (KX-P19)
32K Expansion Buffer Chip (KX-P43)
Re-Inking Fabric Ribbon (KX-P115)

KX-P1180
9-Pin Printer

Print Speed:
(Characters/second)

	Draft	NLQ
Elite	192 cps	38 cps
Pica	160 cps	32 cps

Near Letter Quality Fonts:
Courier, Prestige, Bold PS,
Sans Serif

Resolution:
Draft—9 x 9
NLQ (Sans Serif)—18 x 9
NLQ (All others) —18 x 18

Bit Image (matrix):
240 x 216 dpi

EZ-Set Operator Panel:
Primary functions include:

Font	Line Feed
Pitch	Quiet Mode
Form Length	Perforation Cut
Micro Line Feed	Form Feed

Tractor Type:
Push or pull pinwheel

Paper Feed:

Path	Method
Top	Friction/Cut Sheet Feeder (opt)
Rear	Push Tractor
Bottom	Pull Tractor

Emulations:
Epson FX-86e; IBM Proprinter II

Buffer:
2K (std); 32K (opt)

Noise Level:
55 dbA (Standard);
52 dbA (Quiet Mode)

Dimensions:
16.7 (w) x 13.4 (d) x 5.2 (h) inches
14.1 lbs

Options and Accessories:
Cut Sheet Feeder (KX-P37)
RS-232C Serial Interface (KX-P19)
32K Expansion Buffer Chip (KX-P43)
Re-Inking Fabric Ribbon (KX-P115)

Panasonic
Office Automation

CPD6020

F A C T   F I L E

**Software Bridge,
Version 3.11**
Systems Compatibility
Corp.
401 North Wabash,
#600
Chicago, IL 60611
(800) 333-1395
(312) 329-0700
List Price: $199 for the Combination Package; $149 for the Standard (without ASCII);
$295 for the LAN version (server and up to
three workstations, $69 per each additional
workstation).
Requires: 384K RAM, two disk drives,
DOS 2.0 or later.
In Short: *Software Bridge* is more thorough
and accurate than any other program tested in
this group. It is also simple to install and intuitive to operate, making it truly helpful in
converting word processing files. Not copy
protected.

Software Bridge can also be run directly
from the DOS prompt. You need to give it
just four pieces of information: the input
file, the output file, the input format, and
the output format.

All these details are explained in an attractive, 70-page manual that contains all
the information you need on how to run the
program, including a good quick-start section. It also explains the various options for
the different translation formats and their
limitations. There is a thorough index at
the end.

If there is a problem with *Software
Bridge*, it's that the program runs slowly.
Our conversion timings were based on relatively short documents, and the timing
differences could become either more or
less significant for documents longer than
the one we used. It's clear that for our two-page document, the program took up to
three times as long as the fastest program
in the group tested.

On the other hand, speed is not the
point of conversion software; what you ultimately want are accurate conversions,
and this is where *Software Bridge* shines.

No other program came close to *Software Bridge* in terms of accurately matching the original documents after translation. On average, it lost fewer than 3 points

out of 38 across the 6 test conversions. Its
closest competitor averaged 7.5 points off.
For conversions involving the word processors we used with the sort of document
composed for our tests, *Software Bridge* is
the clear winner.

It should be noted that the program was
not able to go directly to or from *DisplayWrite 4*, but instead used RFT (Revisable Form Text) as an intermediate step
that could be exported or imported by *DisplayWrite*. It did a better job than any competitor at handling RFT files.

Flexible, powerful, and easy to use:
these are the attributes that make *Software
Bridge* attractive for file conversion projects. Its accuracy will truly save you time
and effort, and that's what makes this program the best value of the bunch.

Word for Word

Word for Word is a $149 file conversion
program from Design Software. Like its
competition, it is designed to handle a
wide range of file formats. Unlike the
competing products, however, it has some
interesting and unique wrinkles.

Word for Word lists 32 different file
formats that it can translate, though many
of these 32 are different versions of the
same program (four *WordPerfect* formats,
for example). We tested Version 4.00 of
Word for Word's Professional package,
which came on three floppy disks. There is
also a $79.95 Limited package that supports nine of the most popular word processing formats.

Installation is straightforward. You create a subdirectory, then run a program that
copies the required files to your hard disk.
You can either install selected translation
definitions or instruct the installation program to copy them all.

The program comes with an attractive
manual that is a little light on screen illustrations, but this can be forgiven since the
program is so straightforward to run. The
user interface consists of a Lotus-like
menu bar across the bottom of the screen.

You start by selecting the source and
target document formats, highlighting the
desired format on a list on the screen. Your
choice is marked by a little check mark on-screen, making it easy to see what you
have selected.

You then select the source documents
to be converted. You can request the display of a directory (and can use DOS wildcards to select the files to be listed), then
tag the files you want to convert. You are
limited to a single source directory, but the
output can be sent to a different directory if
you choose.

After you have specified the source and
target files, you can start the conversion.
The program illustrates your progress with
a two-part display. The top half of the
screen shows how conversion of the
source document into an intermediate
stage is progressing. Once it is complete,
the destination document is created and
you can monitor its progress on the lower
half of the screen. A counter at the bottom
tells you how many documents have been
converted and how many have been selected for conversion in all.

The program has some nice added features. For example, you can select your
own colors for the display. Instead of having to deal with esoteric color-display tables, you simply select the part of the display to adjust (such as text or listings) and
press keys to change the color.

Perhaps more practical is a special conversion format called Smart ASCII that is
unique to *Word for Word*. Smart ASCII
deduces formatting instructions from the
way a formatted text file appears. In other

F A C T   F I L E

**Word for Word,
Version 4.00**
Design Software Inc.
1275 West
Roosevelt Rd.
West Chicago, IL 60185
(312) 231-4540
List Price: $149 for the
Professional package; $79.95 for the Limited
package (supports *WordStar, WordPerfect,
Volkswriter, PFS:First Choice, PFS:
Professional Write, PFS:Write, Microsoft
Word, MultiMate, XyWrite*)
Requires: 256K RAM, two disk drives,
DOS 2.0 or later.
In Short: Though versatile and attractive to
work with, *Word for Word* fails to deliver top
quality in conversion accuracy. It is an acceptable second choice. Not copy protected.

Performance Tests: Word Processor Format Conversion Software

Testing of the word processor format conversion software was conducted using a two-page document. Margins were set to one-half inch left, right, top, and bottom, and the first page was solid text. The second page had a set of paragraphs with left justification, full justification, centered lines, and indented lines with double spacing. Type samples included bold, underlined, and bold underlined text and contained flush left, centered, and decimal tabs. The test document also had a forced page break between pages and a running header that appeared on the second page.

The sample document was produced in *WordPerfect* 4.2, *Microsoft Word* 4.0, and *DisplayWrite* 4. We used these programs to print the files on an IBM Proprinter as originals for later comparison. (We chose the Proprinter because it was supported by all three word processing programs and did not require the creation of special print drivers.) All tests were performed on the same IBM PC AT running at 8 MHz, with 640K RAM and a 30MB hard disk.

The files were then converted from each source version to each of the remaining two formats. For the sake of comparison, we timed the process from the last keystroke required to start the conversion until the computer returned control to the operator. We chose not to report the timing results, since differences in accuracy scores were so great that the speed figures became irrelevant. In addition, the timings were made on relatively short documents, and it is possible that better times would

result for larger files because overhead functions would need to be done only once for some packages.

Each package had to perform six different conversions, resulting in a total of 24 tests. The conversions were run using the program default settings. In the case of three of the programs, we had to use DCA RFT format as an intermediate step for *DisplayWrite* and relied on the *DisplayWrite* import and export feature for these files.

The resulting 24 files were then printed using the target word processor on the same Proprinter that had produced the reference samples. These printed results were then scored for accuracy when compared with the originals. We examined 19 items and awarded 0, 1, or 2 points for each. The items were:

- Left margin
- Top margin
- Bottom margin
- Header text
- Header position
- Page 1 text
- Left-justified paragraph
- Full-justified paragraph
- Centered-text paragraph
- Indented paragraph
- Double-spaced paragraph
- Return back to left margin
- Bold
- Underlined
- Both bold and underlined
- Left tab
- Center tab
- Decimal tab
- Page break

```
Print Attributes:

Bold Text   Underlined Text   Bold and Underlined


TABS:  Set at 5, 25, and 45 spaces
       Left Tab              Center Tab            Decimal Tab
       |                     |                     |
       Left Aligned    Centered                    123.45
```

A portion of the test document.

The test results turned up some interesting similarities and differences between the programs.

On the one hand, every program handled the bold, underlined, and bold underlined text without a hitch. All managed to move the body text over safely, although some results required you to have handy a properly formatted original to figure out how the text was supposed to look.

On the other hand, not one of the four programs managed a perfect 38-point score on any of its six conversions. The best, *Software Bridge*, produced one 37-point score. On the low side, two of the test documents had scores of 22, and ten out of the 24 test documents failed to attain 30 points.
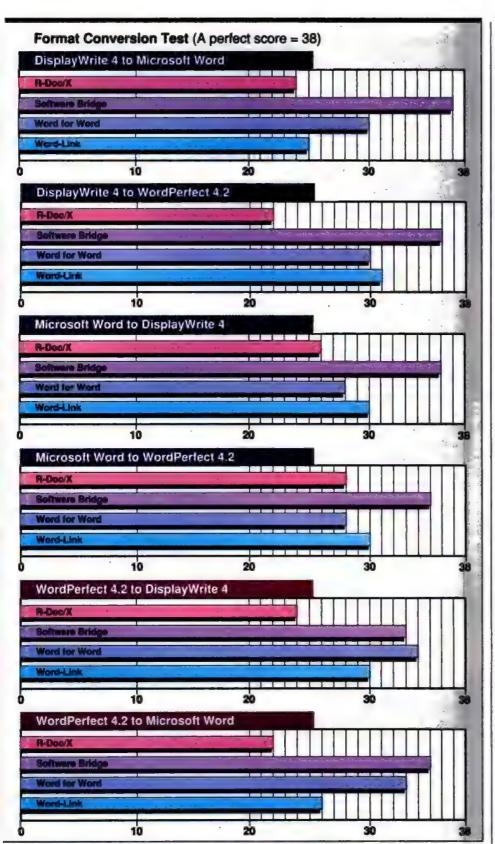
One source of problems was the header. Some conversions lost the text entirely. Others managed to keep it but put it in the wrong place or gave it the wrong margins.

Margins were another stumper. Many programs left the documents to revert to the word processor default settings rather than maintaining the explicit values. This problem might not be excessively difficult to correct, but the conversion program should be able to do it for you.

The other interesting problem was tabs. Every program managed to get some sort of information about the tabs into each converted document. The initial left tab setting worked in every case. In many cases, however, the center and decimal tabs either appeared in the wrong place, or as left tabs, or both.

These problems could take quite a while to correct once the conversion was complete.

Overall, *Software Bridge* fared much better than the others. Only one single conversion by another program (*Word for Word*) achieved a higher score than *Software Bridge*'s lowest score. On the average, *Software Bridge* managed far more accuracy than the other programs by minding its margins, tracking its tabs, and keeping its headers when the others were losing theirs.

words, the program is able to figure out that if there are ten spaces at the start of each line, the page has a ten-space left margin. The result is not as complete as a file formatted by a word processor, but it does beat stripping out many of those extra spaces you get when you try to bring in a formatted text file.

You can also run *Word for Word* from the DOS prompt. All you have to do is pass four parameters: source format, destination format, source file, and target file. Both the source and destination file specifications can use DOS wildcards, so it's

With *Word for Word* it's possible to automate the conversion of many files in a single command.

possible to automate the conversion of many files in a single command that can be added to a simple batch file.

The manual attempts to set reasonable expectations for the product. A boldface notice warns ''Note: Not all features can be converted!'' The claims for the product are a bit more ambitious, however. The preface states that in most conversions, *Word for Word* will produce a converted document containing 99 to 100 percent of the special features.

Our tests with *WordPerfect*, Version 4.2, *Microsoft Word*, Version 4.0, and *DisplayWrite 4* did not reach the 99- to 100-percent success rate that the program hopes to achieve. It earned the second best scores overall, but that result was about equal to the average score for all four products.

Word for Word is adequate, but not excellent, at its work. It supports a large number of popular word processing for-

The conversion screen in Word for Word *splits the process into two steps. The first turns the source file into an intermediate stage, and the second converts that stage into the final format. Two graphs monitor the progress of each stage.*

Word-Link *requires that all source files come from the same directory, but you can tag as many files as you like. Here two files have been selected for conversion. Note the commands at the bottom, which include function keys for tagging and untagging the files.*

mats, although it is a little weak on some of the lesser-known products. Compared with the other three programs tested here, it makes an acceptable second choice.

Word-Link

The title page of the *Word-Link* manual announces: "Easy to use, disk-to-disk document conversions between major PC word processing formats." Which begs the question, how well does the program deliver?

The "major PC word processing formats" part of the statement is simple to evaluate. This $149 package, from M/H Group, supports just seven word processing programs, plus ASCII text files. It should be noted that *Word-Link* recognizes a number of different versions of these seven programs, and you can adjust it to handle their files appropriately. While seven is a small number, those covered include some of the most popular programs.

How about the "easy to use" part? Installation could hardly be easier. The whole system comes on a single disk that you copy into a subdirectory of your hard disk. (*Word-Link* can also be run on a dual floppy disk system.) There are no adjustments required for your CONFIG.SYS file, no special choices to make, and no configuration options to choose. Just copy it and run.

Running the program is simple, too. From the main menu you can select either Convert Documents or Set Document Defaults. The defaults section is handy and powerful, since it allows you to specify some of the details that *Word-Link* cannot figure out on its own from the information in your document files.

When you choose to convert documents, you get a two-column display listing the supported formats. Highlight one on the left as a source format and one on the right as the destination. The next

screen that appears allows you to specify the directories that hold the source and destination files. One interesting limitation of this system is that you cannot use the same directory for both source and destination. Also, all your source files must come from the same subdirectory.

Word-Link is easy to use and converts files adequately.

The next screen displays the source subdirectory, and you can tag files to mark them for conversion. Once you have selected the files you want, you start the actual conversion.

The final screen shows your progress, listing the file being processed and the number of characters converted so far. This screen is not as helpful as it might be since it does not tell you how many characters are left to convert, but it does let you

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CIRCLE 384 ON READER SERVICE CARD

A MATTER OF RECOGNITION

The biggest problem with converting word processing files is finding the correct patterns and replacing the embedded codes with the correct codes for the updated format without losing any of the text. With formats changing so rapidly and new versions of programs hitting the market all the time, is it any wonder that the conversion programs have so much trouble?

Would you like to take matters into your own hands? You could probably write a little BASIC pro-

This is a sample of an Xchange *demonstration program that replaces* WordStar *formatting codes with "pseudocodes" in an ASCII file. Note how in line 5 the underscore character results first in a (us) code for underscore, then a (norm) to show that it has been turned off. The next lines show how certain characters (represented in hexadecimal format) can be replaced.*

gram that would read in a character at a time and run a dozen or so comparisons until it decides what to do with the character. But that program will crawl through even the shortest file.

Professional typesetters turn to a $595 program called *Xchange*, from Emulation Technologies. It is a simple program in one respect: all it does is match patterns in a file and make replacements based on the patterns it finds.

And it does it quickly.

The clever part of the program is that you get to tell it the rules. You create programs called translation files that

FACT FILE: *Xchange*, **Version 1.31A**
Emulation Technologies Inc.
1501 Euclid Ave. Cleveland, OH 44115
(800) 336-2014, (216) 241-1140
List Price: $595; optional file-format translations available $75–$300.
Requires: 512K RAM, hard disk, DOS 3.1 or later
In Short: *Xchange* is a fast and powerful translating program that lets you create custom programs for translations. Its unique pattern-matching command language makes it possible to tackle the most complex tasks. Not copy protected.

CIRCLE **828** ON READER SERVICE CARD

consist of numbered commands. The program then uses these instructions to examine a source file. If the character in hand matches the first command, the program executes the replacement. If it doesn't match, the program then looks to the next command, and the next, and so on until it runs out of commands. Then it gets the next character and checks again. It does all this with great speed.

Xchange offers many optional translation files as add-ons. They are of little use to most PC users, however, since they use word processing formats as sources but end up producing typesetting-machine formats. As a result, you will have to write your own translation file if you want to convert between word processing programs.

If you want to play around with your word processing files and enjoy convoluted logic puzzles, you'll find that you can get more done with two lines of *Xchange* than you can in an afternoon of searching and replacing with any editor. For the same reason, it is also a wonder at manipulating data files before importing them into your database program.—**Alfred Poor**

know that something is happening.

The manual comes in a three-ring binder and consists of reduced typewritten pages. Screen shots are simulated with typewritten charts. The bulk of the manual is filled with explanations of the configuration options under each format and the exceptions you will encounter using each as a destination or source.

Unfortunately, all the information on exceptions is of little use when your document does not convert precisely. It does not save you any time to know that something won't work and you will have to correct it by hand. According to our test scores, you can expect to be making corrections.

Word-Link scored below the four-program average for both *DisplayWrite 4* and *WordPerfect* and only about average for *Microsoft Word*. It had problems with margins, page breaks, and headers. It managed its best results on the *Microsoft Word* to *WordPerfect* test, but the converted file still needed editing to make it match the original.

Word-Link is easy to use: it works with the most popular word processing programs and converts document files adequately, but its low precision in conversion makes it a less attractive product than its competitors.   PC

Alfred Poor is a consultant and analyst in Perkasie, Pennsylvania, and a frequent contributor to PC Magazine.

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HEWLETT PACKARD

COVER STORY DUDLEY BROMLEY, ROBERT DREHER, AND CARNOT G. MILLIGAN

Fed up with using sluggish modems and costly, complicated LANs to move data between PCs and mainframes? An old pro at data exchange—half-inch nine-track magnetic tape—is now a viable medium for PC users.

TO MAINFRAME AND BACK

DATA TRANSFER BY NINE-TRACK TAPE

SINCE ITS INTRODUCTION IN THE 1950s, half-inch magnetic tape has been a vital part of data processing; it was one of the first and best reusable random and sequential storage media. But its most important characteristic has always been its ability to transport data. To this day, it has no competition as a means of storing and sharing large amounts of mainframe data.

Although half-inch magnetic-tape subsystems have been available for PCs since 1982, most PCs lacked the memory and storage capacity required to use them to their full potential. Today, with 1MB RAM and 70MB hard disks becoming common, PCs are catching up. Anyone who must create or maintain large files in a PC environment and exchange them with mainframes should consider using half-inch tape.

Tested for use at 800 BPI through 6250 BPI

TRINITY OF PARTS A typical PC tape subsystem is composed of three parts: an external tape drive, software, and an interface board. Tape drives manipulate tapes, reading and writing data based on commands received from the PC.

The software provided with a tape subsystem allows you to control the actions of the tape and drive. Besides reading from

The software provided with a tape subsystem allows you to control the tape and drive.

and writing to a tape, the software usually allows you to position the tape at a specific point, rewind it, or unload it. The software takes your commands and forwards them to the interface board (or coupler) inside the PC, which translates the commands into instructions for the drive.

The companies that make subsystems generally fall into two main groups: those that build tape drives and those that don't. Those that do will sell you their drive and then add on the controller and software of your choice. Those that don't will sell you their controller and software and then add on the tape drive of your choice. Two exceptions are AK Systems and Telebyte Technology; both companies build complete subsystems, including tape drives and controllers.

Chances are good that you'll need more technical support for the controller than for the drive, so you should always consider the controller the primary component. Once you decide on a controller, you can connect it to whatever tape drive meets your requirements best.

This flexibility is made possible by the

Pertec interface, the industry-standard interface between tape drives and controllers. Because this interface is strictly defined and almost everyone conforms to it, most tape drives will work with most controllers. Many drive manufacturers also offer an optional SCSI interface for their drives.

STREAMERS In the early days of half-inch tape, all drives were known as start/stop drives. For each operation, the tape was accelerated to the appropriate speed, a read or write action was performed, and the tape was decelerated to a stop. Because the combined start/stop distance on the tape had to be less than .6 inches, complex and heavy mechanisms were required to maintain data integrity.

Microprocessors allowed start/stop drives to evolve into streamers. Streamers measure tape position and use this information to get a head start at reading from or writing to the tape, vastly reducing the delays that might occur during tape acceleration. This method leads to less-complex hardware but slows the overall transfer time.

The tape itself is divided into nine tracks. An entire byte (eight bits) is either accessed or written at a time, and the ninth bit (the parity bit) is used for error checking. The density of the bytes on a tape is measured in bits per inch (bpi). The three most common densities are 1,600, 3,200, and 6,250 bpi. The accepted standard, 1,600 bpi, has been used by mainframes for years; 3,200 bpi is available on many of the subsystems in this evaluation, but few mainframes support it. 6,250 bpi is very popular in the mainframe environment, where larger drives and more-complex electronics allow higher densities to be achieved.

A nine-track tape has three basic parts: data blocks, tape marks, and interrecord gaps (IRGs). Tape data is moved in contiguous chunks, each of which is always read and written as a single unit. These blocks usually contain multiple file records; a common ratio is ten file records to one tape block. Tape marks, also called file marks, are special marks that indicate the end of a file on a half-inch tape. IRGs are blank, unrecorded intervals that follow every data block and file mark on a tape. The tape

drive is positioned at one of these gaps between periods of operation.

Our reviews include controllers from five companies—Catamount Corp., Chi Corp., Emerald Systems Corp., Flagstaff Engineering, and Overland Data—as well as the aforementioned complete subsystems from AK Systems and Telebyte Technology. We tested all five standalone controllers using Catamount Model PCT-9S Microstreamer and Qualstar Mini-streamer 1052 tape drives. (The complete subsystems were tested with their own drives.) While both the F880 and 1052 operate at 1,600 or 3,200 bits per inch, they represent diverse performance capabilities. The F880, a noisy, heavy-duty component suitable for rack mounting, has an auto-loading feature and built-in diagnostics. In addition, its Z80 microprocessor eliminates costly mechanical hardware and increases data reliability by implementing data storage and drive functions through firmware.

The 1052 contains an embedded formatter that uses the industry-standard Pertec interface. It can handle all standard sizes of tape reels, and threading the tape is fast and simple. While it can't match the high performance of a Catamount drive, the 1052 is small, quiet, and fully IBM/ANSI compatible.

AK SYSTEMS INC.
AK Systems PCI-100 Interface Board and PCT-1000 Drive

AK Systems manufactures a complete nine-track subsystem that sells for $4,295. The AK Systems PCT-1000 Drive is a manual-loading unit that you can configure as a tabletop unit or mount in a standard 19-inch equipment rack. It can read and write data in either streaming or start/stop mode at densities of 800, 1,600, and 3,200 bpi. Unavailable at the time of review was the new PS-2 system featuring the PC-2000 tape drive, which has much greater mounting flexibility.

The PCT-1000 unit has a complex loading procedure: threading the tape over, under, around, and through the various sprockets, rollers, and hubs is bound to be a real endurance test for even the most pa-

Included in this group are the controllers we evaluated, along with some of the drives with which they were tested. Far left: the integrated Telebyte TDX-50 PC Subsystem, including interface controller, cable, and TDX-50 manual-loading drive. Top left: Catamount ATC-16 controller sitting atop a Catamount Model PCT-9S Microstreamer auto-loading tape drive. Top right: the Overland Data TX-8 controller on a Kennedy 9610 Autoloader tape drive. Far right: Qualstar 1260 tabletop drive unit. Bottom right: the AK Systems PCT-1000 manual-loading tabletop unit and, to its left, the AK Systems PCI-100 controller. Atop the AK Systems drive is Chi Corp.'s PCTD-1 controller. Bottom center: the Flagstaff Engineering Series V8.4 controller and Emerald Systems' Series 8000 MAG-T controller atop a Catamount Model PCT-9G GCR Cache Tape Unit.

tient user. The design of the accompanying interface board, the PCI-100, is based on an early version of Catamount's now-defunct PCT-9 board. While other controllers have made the transition to a round connecting cable, installing this board involves wrestling with two 50-position ribbon cables. Perhaps even more important, AK Systems left off the board's bracket, so you cannot secure the PCI-100 to the chassis. When installed, the board is not fully locked in.

The PCI-100 is an 8-bit interface card

that requires one DMA (direct memory access) channel. It has one problem in common with Catamount's PCT-9 and some other interface boards: during tape I/O, the host computer's operating system can lose track of the current time because the controller inhibits interrupts to increase the efficiency of the data transfer. In a sense, time is made to stand still when the PCI-100 is operating.

AK Systems packages an older version of Catamount's software with its subsystems—a good choice, since the software is

modular in design and uses syntax similar to DOS command structures. Because of the DOS-compatible approach, functions such as piping, redirecting, filtering, and batching are the same with this software as with standard DOS functions and routines. Since only DOS calls are included as part of the software, ROM BIOS and operating system dependencies are eliminated, making this subsystem compatible with the widest possible range of PCs and network environments.

Included among the software utilities is

TPos, a command that gives you control over the tape drive from the DOS prompt—a helpful feature too often neglected by manufacturers. Using TPos, you can space forward or backward a specified number of blocks, send the tape to its beginning or end positions, and unload it completely from the drive. TDump, another utility that some subsystem designers fail to offer, lets you create a printout or listing of the contents of a tape. A number of other options are available, including the ability to position the tape, suppress unwanted data, and alter the display page size.

CATAMOUNT CORP.
Catamount ATC-16
The $1,295 Catamount ATC-16 (Advanced Tape Controller) is an AT-compatible 16-bit board that can handle up to eight tape drives attached in daisy-chain fashion. The ATC-16 uses a single round cable with a D-type connector and requires a DMA channel to operate. For $1,095, you can get the ATC-8, an 8-bit, 64K, half-length interface board for use in XTs as well as ATs. Also available is the $1,495 MCT-16 board for the IBM PS/2 Micro Channel interface.

EXCEPTIONAL PERFORMANCE
The Catamount ATC-16 controller offers a FIFO-buffered (First In, First Out) interface that performs instantaneous data transfers and allows full use of the tape drive's capabilities. Catamount's board offers exceptional performance, rivalled

only by the excellent controllers manufactured by Chi and Overland.

Installing the board is straightforward; you can use the TINSTALL program to change several subsystem default values permanently, including the I/O address, the DMA channel, and the interrupt level. The I/O address selected must conform to jumpers on the interface board. The TINSTALL program also tests the controller and the tape unit for errors in configuration, data transfer, and tape-handling operations.

Catamount's device driver, TDS.DEV, requires installation in the CONFIG.SYS file. TDS.DEV provides access to a tape drive in the same way that DOS provides access to a disk drive. This feature greatly simplifies the task of accessing tapes from high-level programming languages and from commercial software such as *dBASE*, *Lotus 1-2-3*, and others that support standard disk I/O.

Catamount provides two libraries of callable subroutines: a BASIC Programming Support (BPS) library and a General-Purpose Tape Routine (GPTR) library. The manual supplied with the Catamount System provides the assembler source code to ease the programmer's job of creating tape access functions through DOS LINKable subroutine calls.

BACK UP AND RESTORE Catamount's backup-and-restore function is spread across three programs: TBACKUP creates backup images of disk files, TRESTORE retrieves those images, and TDIR provides directories of backup tapes.

These utilities allow you to back up entire systems with a single command, including all logical partitions on a single physical disk. You can use wildcards to specify sets of files, and you can exclude certain files by using the EX switch on the command line.

DT, Catamount's data exchange program, copies and optionally reformats data from tape to disk and from disk to tape. Like all of Catamount's utilities, DT is strictly a command-line-oriented program, and its command syntax adheres to DOS conventions.

Additional Catamount utilities include SEISMIC, a program that allows you to transfer long blocks (over 64K) from tape to disk, and TGET/TRELEASE, which allows a single tape drive to be accessed from two separate PCs.

CHI CORP.
Chi PCTD-1
The $895 Chi PCTD-1 controller is extraordinarily flexible, yet simple to learn and use. Its performance is superior, beating everyone with the Qualstar tape drive and running a close second to the Catamount (which uses its own drive).

The board has a 50-pin connector and a single round cable leading to the tape drive, making installation a snap. After you modify the path statement to allow the operating system to find the control software, all that remains is to run the TDSTART program to initialize the controller. The TDTEST program tests the installation.

Both the DMA channel and the interrupt level for the subsystem are entirely software selectable. The TDSETUP program allows you to select new values if necessary. You can also change the I/O port address by using the TDSETUP program, but doing so requires making hardware changes, as well. Here Chi has once again made things easy by installing a DIP switch at the top of the PCTD-1 interface board to define the I/O port.

TOP-NOTCH SOFTWARE The most impressive aspect of the Chi subsystem is the software. The programs are fast and friendly. You have complete control over the tape drive from the DOS prompt

through the MOVE and REW commands; you can inspect the contents of a tape using the SHOW command; you can write file marks with the MARK command; and you can manage disk files that have been copied to tape using the CYCLE program. In addition, a tape driver (TDRIVER) allows custom software applications written in any language to read and write tape blocks.

Chi's backup-and-restore utilities are extremely versatile. They support wildcards and script files, allowing you to define a complete system backup even if such an operation spans multiple tapes.

COPYIN and COPYOUT are Chi's transport utilities. COPYOUT records files on tape in ASCII or EBCDIC, and you can use it to create tapes that conform to ANSI, IBM, and ISO standards for labeled interchange tapes. Options exist to control tape block size, record size, and many other factors. Multiple files can be processed using wildcards and filename lists. COPYIN provides a similar set of options to control data transfers.

All Chi programs can be command-line driven; you build the commands using DOS-compatible syntax. Because of this orientation, creating command files to execute sets of operations is extremely easy.

EASIER WITH A MENU As easy to use as these programs are, Chi has recently added a MENU program that allows even DOS novices to perform all the tape operations outlined above. MENU guides you through the selected command, and it builds an English-language text as it goes, explaining the operation that is about to be

performed. When all the options are defined, MENU displays the command line as it would appear outside the confines of the MENU program.

Chi's documentation is compact, concise, and clearly written. All in all, this subsystem has much to offer: flexibility, strong performance, and ease of use.

EMERALD SYSTEMS CORP.
Emerald Series 8000 MAG-T

Emerald Systems' $900 8-bit Series 8000 MAG-T interface board has a unique cabling scheme in which the two ribbon cables come together on the computer end

Emerald Systems' 8-bit Series 8000 MAG-T subsystem interface board has a unique cabling scheme.

and attach to the board through a D-type connector. The board fits into any 16-bit expansion slot in an AT.

No device driver is required to run the Emerald Systems software, and every program accepts command-line inputs to change the DMA channel, the I/O address, and the interrupt level. The subsystem's buffer defaults automatically to the amount of free memory.

TIE (Tape Import/Export), Emerald Systems' file transport utility, is command-line oriented and accepts up to 14 parameters that can precisely define any potential transport environment. As with other command-line-oriented programs, you can easily build batch files for control-

ling the transport of multiple files. TIE can transport files at 1,600 and 3,200 bpi and can translate data according to user-defined translation tables.

Emerald Systems' backup utility is called ASP2 (Archive Storage Protector II). ASP2's main menu is a simple box with five utility functions spread across the top. Besides doing backup-and-restore operations, you can change tape density, erase a tape, or examine a tape's directory (assuming it was created using ASP2). Choosing Backup or Restore, you can select either "All Files" (those on the designated disk), "Files" (a subset defined by a filename), or "Time" (all files modified since a specified date and time).

LABELS AND PASSWORDS ASP2 has a couple of unique functions. First, you can put a comment line in the header of a backup, helping you to identify today's backup tape at restore time. Second is a password utility that allows you to protect the files on a backup tape. Unless you issue the correct password, ASP2 refuses to read the files or erase the tape.

Emerald's versatile TTU (Tape Test Utility) allows you to perform a number of diagnostic and related functions. You can position the tape; select tape density; read, write, and erase blocks; and find out the status of the subsystem. Most important, you can run quick and comprehensive tests to verify system performance. The one function missing from TTU—indeed, from Emerald's software in general—is the ability to display specified sections of tape.

FLAGSTAFF ENGINEERING INC.
Flagstaff Engineering Series V8.4

Flagstaff Engineering's $795 Series V8.4 controller has an 8-bit interface and a 512-byte FIFO memory buffer and will work in any compatible machine. Flagstaff also offers the 8-bit Series V6.x and the 16-bit Series V1.2 interface cards. Like the V8.x series, the V6.x series boards will work in all compatible machines, but the V1.2 board is only compatible with 286- and 386-based machines.

The Series V8.4 board requires the use of a DMA channel, an I/O port, interrupts, and one of four device drivers. The documentation is explicit regarding the hardware and software installation procedures, and the test program is menu driven.

Flagstaff's software set includes a wide variety of programs that are for the most part user-friendly and efficient. Flagstaff offers a program that outputs a summary of tape data (number of files, file sizes, and so on), a patch program to modify DOS files, a flexible data-translation routine, a tape-duplicating utility (assuming you have more than one tape drive), and interface packages for C, BASIC, COBOL, FORTRAN, and assembler. Each interface package includes 28 functions that give application programs written in the language complete control over the tape drive.

TBACKUP, Flagstaff's backup-and-restore utility, has a menu-oriented interface that contains a few minor bugs but is generally easy to learn and use. You can back up an entire disk or any subset of files, including hidden files, system files, and read-only files. In addition, you can create an audit file that documents your backup, and you can append multiple backups to the same physical tape. The restore option allows you to review the filenames on a backup tape and restore any or all of those files, either to their original location or to a different directory or disk. The restore option also offers a single interactive tape-drive command that repositions the tape at its beginning.

File transports are accomplished using TAPEUTL. This utility is among the most powerful and flexible tape-transport programs we've seen. With it you can read and write labeled or unlabeled tapes, reposition the tape anywhere, link files, display tape records, write tape marks, change tape subsystem parameters, translate any character or string into any other character or string, and record your inputs so that they can be used to perform similar tape transports in the future automatically.

OVERLAND DATA INC.
Overland Data TX-8 and XL/2

Overland Data's current product line includes two interface boards, the TX-8 ($1,200) and the XL/2 ($1,395). The 16-bit TX-8 card is compatible with traditional bus machines; the XL/2 is Micro Channel–specific. Both cards support the convenient D-type connector with a single round cable.

The TX-8 board's I/O ports and interrupt levels are selected using DIP switches and jumper pins on the card. The CONFIG program provides parameter configuration for the I/O port, interrupt level, drive type (start/stop or streaming), drive number, and the default value for the J2-50 drive's speed/density select line. The XL/2 interface card is easier to configure because of the Programmable Option Select feature of IBM's Micro Channel architecture: the IBM PS/2 Reference Disk's Set Configuration option reconfigures the card.

DMA channels are not required because both boards use programmed I/O. This helps avoid potential conflicts with your existing architecture and allows the effective data transfer rate to improve as

the host computer's CPU speed increases. The XTEST program provides menu-driven system diagnostics for the controller's on-board cache memory and interface status as well as for tape read/write.

Software is available for tape operation under the MS-DOS, Xenix 286, Xenix 386, and Microport 386 operating systems. Also available is a program called *TapeView*, which, when used with Microsoft's QuickBASIC 4.0, creates programs that provide windowing facilities for moving data records between MS-DOS files and nine-track tape.

POWERFUL UTILITIES Overland Data supplies an interactive, window-oriented backup-and-restore utility called Flashbak. This elegantly designed program is a joy to use and simple to learn. It uses pull-down menus and displays the disk's directory structure, filenames, file attributes, and the number of files tagged for the backup or restore operation. Files for the latter operations are selected by disk, directories, matching names, wildcards, attributes, or date/time stamps. Flashbak is a quick worker, able to read and write tape records simultaneously.

A powerful group of standalone DOS utilities is also included. DEPOT (Data Exchange Program with Optional Translation) is present in three versions. The first, simply called DEPOT, is menu driven and provides for data transfer, data translation, and appending data to a previously used tape. DEPOT2 is command-line driven; it offers increased speed and command-file execution and includes data translation, user-specifiable tape locations, and user-

specifiable record sizes. DEPOT2 also allows multiple tape operations through batch files. DEPOT3 provides very flexible data conversion at the byte level for each record.

Other utilities include the interactive, menu-driven FDUMP program, which examines the contents of a tape, and LABEL, another menu-driven utility, which creates a Level 1 standard label for IBM and ANSI standard labeled tapes; it supports multifile volumes and data-set security. The command-line-driven TAR program produces tapes that are readable by Unix or Xenix systems, although it will not convert text files from MS-DOS to Unix or vice versa.

Overland Data provides with its system some excellent source code for the programmer, including drivers and functions in Microsoft C and QuickBASIC, IBM and Microsoft FORTRAN, and Turbo Pascal. Also provided is ALLTAPE, a

multitasking, interrupt-driven programming interface for the controllers.

TELEBYTE TECHNOLOGY INC.
Telebyte TDX-50 PC Subsystem

Like AK Systems, Telebyte Technology manufactures complete tape subsystems. The $5,100 PC/XT/AT-compatible TDX tape system comes complete with the TDX-50 manual-loading drive unit, interface controller, cable, software, and user's manual. (Also available is the $6,995 TDX-450 system, which includes an auto-loading drive unit.)

The TDX-50 tape drive uses start/stop architecture to provide high performance without program restrictions. The vertical-standing unit, which supports 800 and 1,600 bpi and the Pertec interface, features a glass front cover. Since it comes with a

shielded round interface cable installed, you'll have to disassemble the case partially if you want to change the cable. Telebyte's 8-bit interface card comes with light-emitting indicators that provide information if problems arise.

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Selection of the DMA channel and I/O port addresses is accomplished by setting jumpers on the card and by installing the device driver in the CONFIG.SYS file. Unfortunately, I/O port selection is limited to only two addresses. Interrupts are also selected by card jumpers. Unless you have to wrestle with DMA or I/O addresses that cause conflicts with other equipment, installation is easy. A thorough TAPETEST program helps to smooth the process.
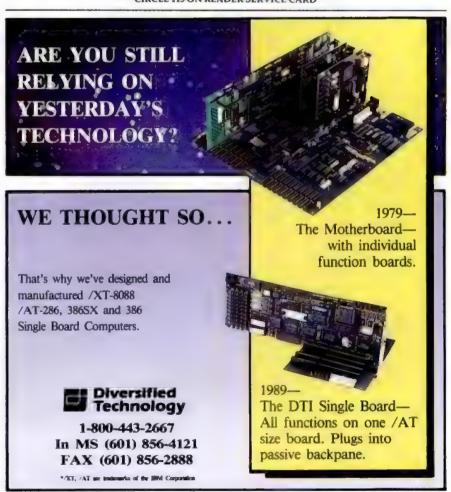
Telebyte provides the usual variety of command-line data-manipulation programs. Most notable are the MTA device, which is the buffer memory area created and used by the system, and the MTC device, which allows the user to send control commands directly to the tape unit.

Telebyte's DATAVERT is one of the most versatile data-conversion programs available; it can handle the zoned, packed, EBCDIC, ASCII, or binary data formats. The subsystem also comes with modules for linking programs with COBOL, FORTRAN, C, and BASIC languages. 🖭

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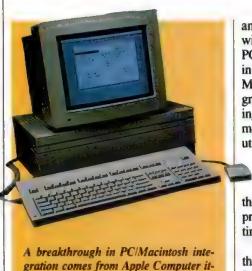
EVEN THE MOST STRIDENT PC booster would have to agree that we now live in a world where integration between the PC environment and the Macintosh environment is essential and inevitable. Both offer valuable advantages, and improving PC-to-Mac communication can only increase overall productivity. No longer do we question the ability to integrate the two systems; instead we try to find the best way to do it.

PC-to-Mac communication has evolved to the point where there is a whole crop of products, in a wide price range, for exchanging data, sharing peripherals, and forming heterogeneous networks. The

A breakthrough in PC/Macintosh integration comes from Apple Computer itself: the $7,769 Macintosh IIx. It directly reads and writes to MS-DOS, OS/2, and Apple floppy disks.

and create data that can be transferred without translation. This means that some PC programs can create and save data files in a format that can be read directly into a Mac application and vice versa. Many programs, especially word processors, are being written with a standard DCA (Document Content Architecture) conversion utility. By saving a document in DCA format, you can transfer it into a different program in a file format compatible with that application. Furthermore, the DCA conversion utility is capable of preserving most of your text file's formatting codes.

Some completely compatible programs that need no DCA translation include the PC and Mac versions of *Microsoft Word*, *WordPerfect*, *PageMaker*, *Microsoft Excel*, *VersaCAD*, and *AutoCAD*. Also able to communicate without translation are Adobe's *Illustrator* (Mac) and *Ventura Publisher* (PC), *Lotus 1-2-3* (PC), and *dBase Mac* and *dBase III Plus* (PC).

The $1,599 Mac286 coprocessor from AST Research, a simple add-in-board solution for Mac-to-PC transfers, allows your Macintosh II to read and write DOS-based data files.

trick lies in determining what you need to do, how frequently you need to do it, and how complex your setup is.

To help you decide which method of transfer is best for you, it's a good idea to look at how the two data formats differ. There are currently seven disk formats in the personal computer arena. The Mac uses 400K, 800K, and, most recently, 1.44MB 3½-inch floppy disks. MS-DOS computers use either 360K or 1.2MB 5¼-inch floppy disks or 720K or 1.44MB 3½-inch floppy disks. The physical formatting of a disk determines the number of tracks, sectors per track, and bytes per sector. IBM formats through DOS with MFM (Modified Frequency Modulation), and Apple uses a technique called GCR (Group Character Recording). When the disks are formatted, a file system moderates the organization of data on the disks. Once again, the two schemes are incompatible: IBM uses the MS-DOS file system and Apple uses HFS (Hierarchical File System).

The need to overcome this incompatibility has encouraged third-party vendors, as well as Apple, to develop products that bridge the gap between the two systems.

TRANSFERRING COMPATIBLE DATA FILES

There are several application programs on the market that are mutually compatible

USING E-MAIL The simplest way to transfer data files that don't need translation between Macs and PCs is through electronic mail services such as MCI Mail or AT&T Mail. Recently, however, other companies have been designing e-mail systems specifically for Macs and PCs. *Desktop Express*, developed jointly by Apple, Dow Jones, and MCI, allows you to exchange Macintosh files with DOS computers running *Lotus Express* or send text messages to MCI users. It is priced at $195. *Dayna Mail*, from Dayna Communications, is a server-based application for Apple and IBM computers. It costs $295 per five-user pack and enables you to send and receive messages across *AppleShare*, *TOPS*, *3+*, and *NetWare* LANs. *Microsoft Mail for the PC* on an AppleTalk network sends phone messages, memos, graphics, and entire disk files between PCs and Macs on a network.

TRANSFER SOFTWARE

A more comprehensive transfer method involves using special software. The first complete package to bridge the gap between PCs and Macs was *PC to Mac and Back* from Dilithium Press. It is still on the market (at $149) but is unable to run on the newer Macintosh II or IIx models. *PC to Mac and Back* transfers BASIC programs, ASCII text, and binary files by modem or direct

cable connection. A more recent software duo from Dynamic Microprocessor Associates allows remote computing from any Macintosh computer equipped with the $99 *PC MacTerm* and a PC running the $145 *pcAnywhere III*. With this combination you can control PC programs, data, peripherals, and internal cards through a modem, a direct cable link, or an Apple-Talk network (with *PC MacTerm/Network*, $395). It is even possible to link to a

Apple's sophisticated FDHD drive even includes a high-density disk detector to format to the correct capacity.

PC and collaborate on a spreadsheet or word processor with both the Mac and PC keyboards active at the same time.

HARDWARE-BASED DATA TRANSFERS

Special drives, such as the Apple PC 5.25 External Drive ($399), also transfer data. If you are a Mac SE or Mac II user, you can read and write files from MS-DOS formatted floppy disks to your Mac. The drive is directly linked to the Macintosh through the Apple Macintosh SE-Bus Drive Card or the Apple Macintosh II PC Drive Card ($129 each). Another external drive that lets all Macintosh systems read and write to DOS disks is the well-known Dayna-File, from Dayna Communications. It is available as a single- or dual-drive unit and accepts all PC-compatible disk formats. Prices for the single unit start at $650; dual drives sell for $905 and up. Although the DaynaFile is able to read, write, and format high-density Mac disks, it doesn't ac-

cept 400K and 800K Mac disks. It connects to the SCSI port of your Mac and can be daisy-chained to up to six other peripheral devices.

The most recent addition to the add-on

drive family is the Apple FDHD Internal Drive, priced at $599. It is similar to but more sophisticated than the DaynaFile. The FDHD drive can read, write, and format all Mac, MS-DOS, and OS/2 disks

and even includes a high-density-disk detector that automatically formats to the correct disk capacity. The latest Macintosh system, the IIx, is equipped with the FDHD Internal Drive.

Another hardware solution, the Copy II PC Deluxe Option Board from Central Point Software, enables you to read and

Transferring by tape-backup is an innovative idea, and two companies have introduced such systems to the market.

write Mac data files if you have a PS/2 Model 25 or 30 or an AT compatible with an internal 3½-inch floppy disk drive. The $159 board is supplied with the Macintosh Control Program (MCP), which controls the transferring of data in and out of the Macintosh format. To facilitate these transfers, the MCP uses a command format that is almost identical to DOS. Batch files that imitate the syntax of DOS commands are used, and an M is placed in front of all commands. For instance, MFORMAT will format a Macintosh floppy disk.

TAPE BACKUP SOLUTIONS
Transferring by tape backup is an innovative idea, and two companies have introduced such systems. Tecmar has developed a $395 interface card called Nu-Link that allows IBM and Apple users to share tape-drive systems. The card goes into a Mac II or IIx, and you use tape cartridges to migrate data to and from any PC. The second company, Irwin Magnetics, has also developed a range of tape-drive systems that permit data to be transferred

between computers. You just send the data from your Mac to a minicartridge in an Irwin Tape Backup System/Minicartridge Tape Drive, load the tape into a PC-based tape drive, then download the Macintosh files onto your DOS hard disk in the right format. The Mac drives start at $1,395, and the PC units are priced at $699 and up.

TRANSLATION SOFTWARE SOLUTIONS
Not every program can be transferred without the help of file conversions. Many Macintosh applications contain codes that are not

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recognizable by PC applications (and vice versa). Frequently these codes signify formatting details like underlining, bold-faced, and tab settings. Translation applications are designed to exchange the data files while preserving the formatting attributes of the program from which they came. An application's codes are translated into codes that the receiving program can understand.

A translation program with text and binary transfer options lets you transfer any type of file, including graphical formats that are common to both PC and Macintosh environments.

Apple offers its own version of translation software, the *Apple File Exchange Utility*, for $49. The utility can be used with multiple translators simultaneously by indicating which files you want translated. The program selects the appropriate translator from the available set. It includes translators for text, binary, and DCA-RFT (Revisable Form Text) formats and is packaged with several Apple products, including the Macintosh II PC Drive Card, the Macintosh SE-Bus Drive Card, and the $249 Apple LocalTalk PC Card. It can also be used for translation with the Macintosh IIx, the FDHD Internal Drive, DaynaFile, and the PC 5.25 External Drive.

The best-known translation software package is *MacLink Plus* from DataViz.

One of the most convenient ways to transfer data is through software products. For $195 DataViz's MacLink Plus helps you convert your files easily by using a Mac-like window format.

The $195 program comes with Macintosh software, PC software in 5¼- and 3½-inch formats, and cabling. *MacLink Plus* is a Macintosh-oriented program that is displayed as a Mac window to provide complete visibility for transfers and translations. It provides access to several DOS devices: a desktop PC; a laptop connected to the Mac; a printer port with the serial cable; a remote PC connected through a modem, remote disks from an AppleTalk server; or one of the add-on Macintosh/DOS disk drives. *MacLink Plus/Translators*, a complete library of file translators, is sold as a separate module for $159. It may be used in conjunction with *MacLink Plus* or the *Apple File Exchange Utility*. Dayna Communications offers *Dayna Translation Software*, a customized version of *MacLink Plus* that works with the DaynaFile.

Traveling Software markets a translation package similar to *MacLink Plus* called *Lap-Link Mac*. It retails for $139.95 and includes software and cabling for both PCs and Macs. *Lap-Link Mac* is a PC-oriented program that must be installed on both computers to exchange files in both directions. All actions are initiated on the PC, and the program is capable of binary transfers.

Insignia Solutions' *SoftPC*, a $595 software product for the Mac SE and Mac II, operates on a different concept. It emulates PC-XT hardware: a processor, 640K of RAM, CGA video, two serial ports, a parallel port, a Microsoft Mouse, ROM BIOS, one 360K floppy disk drive, and three hard disks. Insignia Solutions calls it "synthetic hardware." You can't insert PC disks into your Mac drive, however. A utility called SlavePC transfers data from a PC through a serial cable into the Mac, and you can save PC files to Mac disks, cut and paste text and graphics, convert PC program printing codes to Macintosh print information, and print to any PC printer that is connected to your Mac's serial port.

TRANSLATION HARDWARE SOLUTIONS

Following the same principle as *SoftPC* is the AST Mac286 MS-DOS coprocessor from AST Research. The $1,599 Mac286 brings AT performance to the Macintosh II, including 640K of memory for DOS applications. On screen, the board creates a look like a Macintosh application, with a window from which you can copy and paste text or graphics from DOS applications; save PC and Mac files to the same disk; toggle the Macintosh mouse to emulate a Microsoft Mouse; and gain access to LaserWriter and ImageWriter printers. Obviously, you are not able to insert DOS formatted disks into your Macintosh II.

■ MAC TO PC

You need to seek out additional hardware alternatives. DOS applications can be loaded through the Apple PC 5.25 drive, the DaynaFile 3½-inch drive, or a network, and they run exactly as they do on an AT.

PERIPHERAL SHARING
If you are not interested in sharing data with a Macintosh but would like to take advantage of a high-quality Apple printer, the $399 AppleTalk PC Card is a

> On a TOPS system from Sun Microsystems, each computer on the network can act as a file server or a network station.

good (if slow) choice. The half-length card connects your PC to an AppleTalk network through the Apple LocalTalk Cabling System ($75 per kit), allowing you to print documents on an Apple LaserWriter or LaserWriter Plus. The TOPS network operating system also has an optional module called *TOPS NET Print* ($189) that allows peripheral sharing. With additional software, such as the *InBox* from TOPS, you can share information with Macintoshes on the network. The *InBox* software is priced at $249 for one message center and three clients.

FILE AND PERIPHERAL SHARING VIA NETWORKS
To share file information as well as peripheral hardware, you have to seek out network solutions. One of the first network systems developed to integrate PCs and Macintoshes was the TOPS network from Sun Micro-

systems. On a TOPS system, every computer on the network can act as a file server or network station and can access printers, disk space, and data files. Requests from each machine are translated into codes that can be recognized by the *TOPS Network Software* installed in any of the other computers on the network. To hook your PC into an AppleTalk network equipped with TOPS software you must use the Flash-Card interface card. *TOPS Network Software* for the Macintosh sells for $249 per station; the PC version is $289 per station.

3Com approaches the file-sharing problem from a PC point of view, allowing Macintoshes to link into Ethernet. 3Com's *3+Mac*, priced at $495 per server, is an extension of the 3+Share network operating system and lets the Mac user access the network through a LocalTalk port on the file server. The file server allows several users to access the same file and print services.

Apple gets into the networking picture

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■ MAC TO PC

with the Apple LocalTalk PC Card, a $249 half-length card for the PC bus that allows a PC user to access the AppleTalk network through LocalTalk cabling. In conjunction with *AppleShare PC* software ($149 per station), the card allows you to utilize e-mail, print services, storage space, files, and peripherals as a Mac user. The inclusion of the *Apple File Exchange Utility* lets you share files created under different operating systems. Also available is the $699 Apple Macintosh II EtherTalk Interface Card, which plugs into a Macintosh II slot and provides direct connection to an Ethernet-based network.

Dayna Communications offers Dayna-Talk, which is available as either a $189 connector box that plugs into the printer port of your Macintosh and then into a LocalTalk connector box, or as a network interface card for the PC ($289) that provides you with LocalTalk connectivity. Used either way, DaynaTalk enhances the performance of LocalTalk by increasing data-transmission speeds. It can be used with any AppleTalk-compatible network

DaynaTalk enhances the performance of LocalTalk networking by increasing data transmission speeds.

that uses LocalTalk cabling.

The Kinetics Division of Excelan manufactures products that connect Apple computers to Ethernet networks. EtherPort II ($695) and EtherPort SE ($850) connect Macintosh II or SE computers to networks with EtherTalk compatibility. The $2,795 FastPath, a gateway box, provides Ethernet connectivity for AppleTalk LANs. Kinetics also offers *Host Access Software*, a $595 collection of software products that gives your Macintosh direct access to multiple hosts on Ethernet. It contains Telnet, which allows you to log on to a TCP/IP host computer, and a utility that lets you list local or remote directories and transfer files from one host to another.

Novell has also embraced the Mac environment. *NetWare for the Mac* ($200) provides a gateway on the server that allows your Mac to use network resources transparently. Your Mac can hook up to the server through LocalTalk or Ethernet.

Stephanie Izarek is an editorial assistant at PC Magazine.

PC MAGAZINE F A C T F I L E

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Alameda, CA 94501
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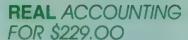
Infection Protection

Protecting yourself
from computer viruses
depends more on
common sense than on
obsessive fortress building,
but an early warning
system can help.
PC Labs looks at
11 resident programs
that sound the alarm
when a virus strikes.

PC LABS Like its biological counterpart, a computer virus is an agent of infection, insinuating itself into a program or disk and forcing its host to replicate the virus code. Hackers fascinated by the concept of "living" code wrote the first viruses as projects or as pranks. In the past few years, however, a different kind of virus has become common, one that lives up to an earlier meaning of the word: in Latin, *virus* means *poison.*

These new viruses incorporate features of another type of insidious program called a Trojan horse. Such a program masquerades as a useful utility or product but wreaks havoc on your system when you run it. It may erase a few files, format your disk, steal secrets—anything software can do, a Trojan horse can do. A malicious virus can do all this and then attempt to replicate itself and infect other systems.

The growing media coverage of the virus concept and of specific viruses has promoted the development of a new type of software. Antivirus programs, vaccines—they go by many names, but their purpose is to protect you from virus

attack. At present there are more antivirus programs than known viruses.

Some experts quibble about exactly what a virus is. The most widely known viruses, the IBM Xmas virus and the recent Internet virus, are not viruses at all according to some experts because they do not infect other programs. Others argue that every Trojan horse is a virus—one that depends completely on people to spread it. The distinction doesn't matter to the antivirus programs. Whether the attempt to format your hard disk comes from a virus, a Trojan horse, or you yourself (by accident), the program should sound the alarm.

HOW THEY REPRODUCE Viruses can't travel without people. Your PC will not become infected unless someone runs an infected program on it, whether accidentally or on purpose. PCs are different from mainframe networks in this way—the mainframe Internet virus spread by transmitting itself to other systems and ordering them to execute it as a program. That kind of active transmission is not possible on a PC.

Virus code reproduces by changing something in your system. Some viruses strike COMMAND.COM or the hidden system files. Others, like the notorious Pakistani-Brain virus, modify the boot sector of floppy disks. Still others attach themselves to any .COM or .EXE file. In truth, any file on your system that can be executed—whether it's a program, a device driver, an overlay, or even a batch file—could be the target of a virus.

When an infected program runs, the virus code usually executes first and then transfers control to the original program. The virus may immediately infect other programs, or it may load itself into RAM and continue spreading. If the virus can infect a file that will be used on another system, it has succeeded.

WHAT THEY CAN DO Viruses go through two phases: a *replication* phase and an *action* phase. The action doesn't happen until a certain event occurs—perhaps reaching a special date or running the virus a certain number of times. It wouldn't make sense for a virus to damage your system the first time it ran; it needs

some time to grow and spread first.

The most vulnerable spot for a virus attack is your hard disk's file allocation table (FAT). This table tells DOS where every file's data resides on the disk. Without the FAT, the data's still there but DOS can't find it. A virus could also perform a low-level format on some or all tracks of your hard disk, erase all files, or change the CMOS memory on AT-class computers so that they don't recognize the hard disk.

> One virus finds four consecutive digits and switches two. Let's hope you're not balancing the books when this one hits.

Most of the dangers involve data only, but it's even possible to burn out a monochrome monitor with the right code.

Some virus assaults are quite subtle. One known virus finds four consecutive digits on the screen and switches two. Let's hope you're not balancing the company's books when this one hits. Others slow down system operations or introduce spurious errors.

VIRUSES UNDER EVERY BED The CMI disk drives in IBM's first AT computers had an amazing failure rate. It wasn't a matter of *whether* your particular disk would fail, but *when*. When it finally did break down, you sighed and replaced it. These days, though, you'd probably assume that a virus caused the problem. Operator errors, program bugs, and hardware glitches cause many more problems than viruses do—in fact, you'll probably never see a virus—but a failed hard disk isn't front-page news.

Many of the media's virus stories have warned against software downloaded from BBSs (bulletin board systems). In theory it does sound dangerous to use programs whose source is unknown, but as *PC Magazine* editor-in-chief and publisher Bill

Machrone points out, "All major viruses to date were transmitted by commercial packages and private mail systems." Just because you open the shrink-wrapped package yourself doesn't mean the program is safe: some companies routinely repack and rewrap returned program disks.

WHAT CAN YOU DO? There are a number of simple things you can do to protect your system, some of which are detailed in the sidebar "Ten Simple Steps to Virus Protection." For active protection, consider installing one of the antivirus products reviewed here. These programs perform one or more of the following functions: prevention, detection, vaccination, identification, and damage control. The functions overlap somewhat, and most products perform several.

■ **Prevention** products keep the virus from infecting your system in the first place. They forbid changes to executable files so the virus can't get a foothold. Some refuse to let any program make itself resident in RAM unless you've approved it. Others don't allow you to run any program unless it's on a list of approved and tested applications. Most of the programs we chose to evaluate come from this category because these products seem to offer the best frontline protection.

■ **Detection** products warn you after a virus infection—they watch for virus effects. These products check your executable files, boot sector, and so on, and compare them with a previously recorded *signature*. This signature is created by feeding every byte of the file into a (usually secret) algorithm that yields a large number. The probability that anyone could change the program without changing the signature is infinitesimal. Some products check the signatures of all files at once, while others check each program as you run it.

■ A **vaccination** product actually "injects" itself into each of your executable programs. In a sense, it's like a benign virus. When the vaccinated program starts, the injected code performs a signature check and warns if there have been any changes. Unfortunately, by the time you get the warning, the file has already been infected and the virus code has already executed. And if the program performs its

TEN SIMPLE STEPS TO VIRUS PROTECTION

If virus threats have you worried, keep your data safe by taking refuge in these common-sense hints.

1. First and always: make frequent backups! One set is not enough—use several sets of backups in rotation, perhaps one for each day of the week. Setting up a regular backup system will help you recover from hard disk crashes, accidental formatting, and malicious programs. You're a lot more likely to suffer a hard disk crash than a virus attack; backups will help protect you from both.

2. If you determine conclusively that a virus has infected your system and destroyed data, you can probably recover the information by using a recent backup. Shut off the system, then boot it from your original DOS disk (with a write-protect tab on it). Format the hard disk using FORMAT.COM from the original DOS disk and do a selective RESTORE. You should restore *only* the data from your backups. To put your programs back, get the original disks down off your bookshelf and reinstall them.

3. Always put write-protect tabs on floppy disks that don't need data written to them. If you get a "Write protect error writing drive A:" unexpectedly, something improper is going on.

4. Software downloaded from bulletin board systems hasn't been implicated in a major virus outbreak—yet. Nevertheless, there are steps you can take to be doubly safe. Use established BBSs in which the sysops check the software they post. If the sysop makes a point of getting programs directly from authors, that's even better. Wait several weeks before downloading a new program to see if any problems are surfacing.

5. Make all of your .COM and .EXE files read-only. Under DOS 3.3, you can do this with just two calls to ATTRIB, one for .COM and one for .EXE. From the root directory, enter the command ATTRIB +R *.COM /S. The /S switch causes ATTRIB to execute the command in all subdirectories. Do the same for .EXE files. If your DOS version is pre-3.3, you'll have to either manually run ATTRIB in every directory or use a utility like *PC Magazine*'s SWEEP.COM.

6. Move COMMAND.COM out of the root directory. Edit your CONFIG.SYS to include a line like

    SHELL=C:\HIDDEN\COMMAND.COM /P

replacing HIDDEN with whatever directory you choose to keep it in. Add the line

    SET COMSPEC=C:\HIDDEN\COMMAND.COM

to your AUTOEXEC.BAT. You can even hide COMMAND.COM and the directory it's in by using *PC Magazine*'s ATTR.COM.

7. Don't loan out program disks—they may come back infected. If you have a legitimate reason to loan a disk, make a DISKCOPY and format the disk when you get it back.

8. On a floppy disk drive system, use only one boot disk. Write-protect it and never boot from any other. If you have a hard disk, never boot from a floppy.

9. Don't let anyone else use your system. If that's not feasible, at least don't let them bring their own program disks.

10. Don't use illegal copies of programs that have been "hacked" to remove copy protection. In one instance, a hacked version of a game program contained destructive code that was triggered by winning the game.—**Neil J. Rubenking**

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own internal integrity checking, the vaccine will set off alarms.

■ **Identification.** Some antivirus programs try to identify known viruses by looking for specific byte patterns. This isn't a very practical method, as a tiny change to the virus code can defeat it. But in conjunction with other methods it couldn't hurt. Many BBSs offer programs that scan files for strings of ASCII characters and display them. If the search turns up lines like "Arf! Arf! Gotcha!" you can avoid running that program.

■ **Damage control.** Any antivirus program you choose should offer damage control, both preventative and restorative.

> Any antivirus program you choose should offer damage control.

Preventative techniques include stopping attempts at direct disk access, warning about programs that unexpectedly insert RAM-resident code into memory, even "write-protecting" your hard disk while you test unfamiliar software. If worst comes to worst and your disk is formatted by a virus, you may be able to reverse the damage if your antivirus program maintains a copy of the FAT. Unless the virus has completed a low-level format, your data is still there.

Besides these standard protective measures, some antivirus programs offer related helpful features. If the program saves a copy of your CMOS memory, you can probably use it to restore your setup after the battery goes dead. When you accidentally start to copy one executable file over another of the same name, the antivirus program may warn you. There's a flip side, though. Your antivirus program may

refuse to let you run those applications that store default values by changing the program file, and most antivirus programs will object if you attempt to use a low-level disk editor such as *The Norton Utilities* or *Mace Utilities*.

VIRUSES AND OS/2 It's too early to know whether viruses will flourish or founder under OS/2. As of this writing, no OS/2-based viruses have been found. Our own OS/2 experts agree that it will be more difficult to write an OS/2 virus, but it will also be more difficult to write an OS/2-based antivirus program. Some OS/2 features do, however, provide ammunition for the antivirus arsenal. For example, since OS/2 permits multiple threads to run concurrently, you could have a program

> **Our tests show that antivirus programs are not foolproof, but to anyone living in fear of viruses, every little bit helps.**

continuously working to compare your executable files with their signatures.

WHERE VIRUSES COME FROM Who writes viruses? In some cases they are merely experimenters with more skill than sense. One well-known Macintosh virus did nothing but display a "peace message" on a given day. The authors of the Pakistani-Brain virus infected bootleg disks that they sold to foreigners in an act of twisted righteousness. And if we're to believe the media, the Internet virus brought down a nationwide mainframe system simply because its author didn't realize how fast it would spread.

Our tests show that antivirus programs are far from foolproof, but to anyone living in fear of viruses, every little bit helps. After all, the really nasty viruses are the work of terrorists. If someone lobs a bomb into your office and destroys your records, is it

so different from having those same records destroyed by a virus attack? Neither event is very likely, but if you had a program that might keep that bomb from coming through your window, you'd use it, and you'd hope it works.

Neil J. Rubenking is a contributing editor of PC Magazine.

C-4

C-4 is a classification that the United States government places on a certain level of computer security detection and protection. This is the level of protection that InterPath is attempting to address with *C-4* ($39.95), its antivirus shield program.

Once *C-4* is loaded into memory as a TSR, it continually monitors DOS interrupts for potential virus infection. If the monitoring process detects any abnormal behavior, it immediately halts the potentially offensive program and issues a message in a pop-up window explaining what it thinks might be wrong.

Your options upon receiving a pop-up message are simple: either hit Y to allow *C-4*'s complaint to be ignored and let the behavior continue, or hit any other key to prohibit the activity from taking place. This warning also gives you the opportunity to put a DOS disk into the floppy disk drive and reboot the machine from there to remove or analyze the potential virus.
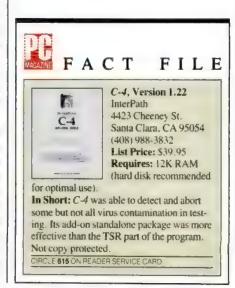
Like most virus detectors, *C-4* will generate false alarms from time to time. Usually, these are caused by the activity of other TSRs that need to do specialized things. For instance, a user may need an enhancement to DOS and may devise a special solution to his or her problem using a TSR. Within that TSR, however, there could be code that might be viewed as potentially harmful by *C-4*.

In addition to TSRs, there is also a class of standard DOS command programs (such as FORMAT or FDISK), as well as commercial systems software applications (like *The Norton Utilities*) that can trigger *C-4*. In these instances, the user must make a decision about how to deal with *C-4*'s warnings. If you run FORMAT only once a week, you may not be bothered by a message from *C-4* informing you about your formatting activities. However, if

you find that you use FORMAT or any other false-alarm-triggering program often, you can deactivate *C-4* simply by hitting the Ctrl-4 key combination. This lets you put *C-4* to sleep (it still remains in memory) for as long as you like. During the downtime, *C-4* will perform absolutely no checking. If you turn off *C-4* after you have already started up a program, it will automatically wake itself up once the program is finished. If you turn it off while at the DOS prompt, however, it will remain off until you toggle it on again.

C-4 also gives you the capability of maintaining a list of programs that you consider to be secure by adding them to the command line whenever *C-4* is invoked. When *C-4* has this information, it checks the list against the currently running command. If the command is in the list, the program will not issue any warning. As you make modifications to the list, *C-4* will modify itself on-disk and in memory to account for the list additions. This is also important for security, since there does not need to be a special file on-disk for the purpose of maintaining all the programs in the list.

A standalone add-on program called C4ADD comes in the *C-4* package. When you invoke C4ADD from the command line or place it as the first command in your AUTOEXEC.BAT file, it will determine if either your COMMAND.COM file or your hard disk's boot sector has been corrupted in any way. In the former case, it

Virus Protection Software: Summary of Features

(Products listed in ascending price order)

	Flu Shot+ $10.00	Mace Vaccine $20.00	Virus Guard $24.95	C-4 $39.95	Vir-X $59.95	Dr. Panda Utilities $79.95	SoftSafe	Disk Watcher $99.95	Vaccine $129.95	Virusafe $150.00	Certus $189.00
OPERATIONAL FEATURES											
Uses checksum	●	○	●	○	●	○	●	○	●	●	○
Uses CRC (cyclic redundancy checking)	●	○	○	○	●	○	○	○	○	●	●
Uses non-CRC proprietary signature	●	○	○	○	○	■	○	○	■	■	○
Requires lists of files, directories, and so on, before using	●	○	○	○	■	●	○	○	○	■	■
Operates on boot-up	●	●	●	●	●	■	●	●	●	●	■
Offers password protection	○	○	○	○	○	○	○	○	○	○	●
Maintains operational log	○	○	○	○	○	○	○	○	●	○	■
PROTECTION FEATURES											
Uses signature methodology	●	○	■	○	●	●	○	○	■	●	●
Uses encrypted checksum	●	○	○	○	○	○	●	○	●	●	○
Uses other checks (example, size, data, time, attributes, location)	○	●	○	○	●	■	○	○	○	■	●
Monitors DOS interrupts	●	●	●	●	●	■	○	●	●	■	●
Monitors interrupt vector table	○	○	○	■	●	■	○	○	●	■	○
Protects critical system areas	■	■	●	●	●	■	■	●	●	●	●
Protects boot sector	■	■	●	■	●	■	●	●	●	■	●
Protects COMMAND.COM	●	●	●	●	●	■	■	●	●	■	●
Protects hidden system files	■	■	●	■	●	●	●	●	●	■	●
Protects FAT (file allocation table)	■	■	○	■	○	■	○	●	●	■	●
Protects partition table	■	●	○	●	○	■	○	●	■	○	●
Protects RAM	■	○	○	○	■	○	○	○	●	■	○
Can restore CMOS	●	○	○	○	○	○	○	○	○	●	●
Protects logical drives beyond C:	●	●	●	●	○	■	●	●	●	●	●
DETECTION FEATURES											
Detects at boot-up	●	○	■	○	●	■	●	●	●	●	●
Detects on demand	○	○	○	●	■	■	●	○	●	●	●
Detects before program execution	●	●	■	○	■	○	○	○	●	○	●
Notifies when a program goes TSR	●	○	○	■	●	■	○	○	●	●	○
Flags new programs	○	○	■	○	○	○	○	○	■	○	●
Flags programs with changed signatures	●	○	■	○	●	■	○	○	●	○	●
Uses integrity statistics	■	○	●	○	●	■	○	○	●	●	●
Uses write traps	●	●	○	●	●	■	○	●	●	●	●
Uses read traps	■	○	○	●	○	■	○	○	○	○	●
Uses program integrity checks	●	○	●	○	●	●	○	○	●	●	●
Uses memory integrity checks	●	○	○	○	○	●	○	●	●	■	○
Uses critical-area integrity checks	●	●	●	○	●	●	●	●	●	■	●

■—Editor's Choice ●—Yes ○—No

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will remove the offending code from COMMAND.COM to prevent the virus from spreading any further.

InterPath also markets a product called *Tracer*, which, in addition to C4ADD, will analyze all your device driver .SYS files, as well as perform branch address detection on your .COM and .EXE files to see if any code has attached itself to your executable files.

In our testing, *C-4* was successful in catching the TSR virus, but, like most of the other programs, it did not prevent the Lehigh or the KILLER virus from getting through. Testing with a virus simulator showed that the program covers several DOS interrupts and offers some IOCTL (input/output control) protection.

C-4 offers reasonable virus detection and protection and helps stop further contamination of your system, but since the program monitors only one class of system intrusion (DOS interrupts), it does have its limits. There are other products available in the same $40 price range that offer additional features.—**Greg Comeau**

Certus

FoundationWare's *Certus* (formerly *Corporate Vaccine*) is the Cadillac of the security and integrity world. This package does everything but slice bread. At $189, it's not cheap, but it is very complete and has a number of unique features.

The packaging of the product is slick. There is a full-sized, very thorough manual plus a videotape that walks you through the installation and use of the product. *Certus* is definitely oriented toward the corporate marketplace—and it's a good thing, too, since unlike most other antivirus products, it requires a minimum of 512K RAM for installation (the runtime requirement is smaller).

The philosophy behind *Certus* is predicated on the belief that the virus threat is merely one aspect of maintaining overall system integrity. The list of utilities in *Certus* is therefore quite impressive. It consists of 34 files that prevent corrupted programs from executing, log which programs have been run, allow recovery from corrupted FATs and reformatted disks, protect against loss or corruption of the CMOS memory in ATs and compatibles, and pro-

tect against the corruption of critical DOS disk areas.

These files are grouped into a few major categories. There is the Survey module, which attempts to stop most undesirable disk operations such as reformatting

> **The purpose of *Certus* is to maintain system integrity against all kinds of problems, be they accidental or virus-related.**

the disk, writing into the partition table, or writing into the boot sector.

In the authentication category, you find Resident, a small TSR program that compares programs against their signatures before allowing them to run and includes various utility programs for maintaining the database.

There is the critical information category, which contains programs that preserve the CMOS memory information so that it can be restored. It also contains a collection of programs that maintain what FoundationWare calls the Critical Disk and some copies of the FAT.

The Critical Disk, along with copies of the FAT that are kept on your hard disk, can be used to recover data even after reformatting and repartitioning your disk. This is possible because DOS has not actually destroyed any information—it has just lost all of the tables that tell it where to find the data. Enough information is maintained on the Critical Disk to restore the drive to the point where *Certus* can find the copies of the FAT that it carefully stowed away in case of emergency.

Of course, if you fail to give *Certus* the opportunity to squirrel away these FAT files, you lose your protection. *Certus* includes a utility that aids in adding FAT checks to your .BAT files and automatically adds the check to the AUTOEXEC .BAT. If you ever deliberately repartition your hard disk, you'll need to recreate the

the *Certus* Critical Disk.
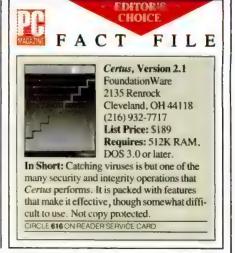
The Shelter utility, which creates the Critical Disk, has another useful function. It can be used to remove the hard disk information from CMOS so that your computer no longer believes that there is a hard disk installed. This offers a way to play computer games without worrying about a bug or other problem destroying your hard disk data. When you are through playing and want to access the hard disk again, just reboot with your Critical Disk to restore everything to normal.

A unique *Certus* feature is its Blue Disk, which contains the signatures for many popular applications. This way, when you get a new disk from your computer club, you can use the Blue Disk to ensure its integrity.

Certus offers several levels of Quality Assurance, a feature that determines how much time Resident spends checking files against their signatures. There is also a security level that allows you to differentiate between authorized users, who can override certain security traps, and unauthorized users. There is even an option for password protection.

Proper selection of the Quality Assurance level is critical because choosing one that is too high will slow the system down to the point where one might be tempted to remove the integrity checking. QUICK .EXE, which allows on-demand checking, always does the most-detailed signature analysis.

Certus had more success than most of the other programs at containing the Le-

high virus, and it did notice that something was up when the KILLER virus was introduced—but it didn't control the damage. It was not very effective against the TSR virus used in testing.

The purpose of *Certus* is to maintain system integrity against all kinds of problems, be they accidental or virus-related. To that end, the *Certus* system is exceptionally good. The product is complicated (some users may have trouble configuring it optimally) and slow to install, but for those who take the time, it offers a tremendous amount of peace of mind.

—Noel Bergman

Disk Watcher

Disk Watcher acts like the guardrails on a highway: it prevents the user from inadvertently invoking any action that might damage the system.

The $99.95 program from RG Software Systems is actually a fairly competent RAM-resident DOS shell program with some extra bells and whistles added. The DOS shell is brought up by pressing a hotkey combination. When you are in the shell, you can do all the typical shell functions of copying, moving, deleting, and viewing files. It also comes with a DOS 3.3–compatible BACKUP command and a separate RESTORE utility if you are not running DOS 3.3.

Disk Watcher also monitors DOS so

Virus protection is but one part of Disk Watcher's *varied disk utilities. Here, the program has caught the virus simulator (SIM.EXE). Five ways to proceed are presented, and the choice is up to you.*

that certain critical events can be avoided. It watches for a disk-full condition, an attempt to format the hard disk, an attempt to dump the screen to the printer by using the Shift-PrtSc key combination, and a printer off-line situation. It will warn you when you have not set the system date and time, and you can use the program periodically to erase files that match a certain specification (such as *.BAK).

Disk Watcher notifies you if a program tries to modify the contents of an .EXE or .COM file or attempts to create a file that already exists (a common task that users often perform).

So as a file manager, *Disk Watcher* is fine—but will it catch viruses? The supplement to the manual that comes with Version 2.0 says that *Disk Watcher* will automatically check all active disk drives upon system start-up for the presence of virus-like conditions. In our tests, however, it didn't do much in this regard.

Disk Watcher warns you if it detects the addition of hidden files and system files, and it also warns you if a program tries to alter the system variable that DOS uses to tell itself how much memory is in the system, but it doesn't go much further. You can't tell *Disk Watcher* which files to monitor for possible virus attacks, and the program does not use the signature method of determining a file's integrity. According to RG Software, all file checking is dynamic, and the company didn't want to say exactly how *Disk Watcher* implements its checking scheme for fear that the information would allow virus writers to bypass

the protection scheme. Nevertheless, many technically oriented users would like to know exactly what measures a program takes to stop a virus.

During testing, *Disk Watcher* didn't catch the Lehigh virus at all, and when the TSR virus (which *Disk Watcher* also failed to detect) was introduced, our system displayed some bizarre behavior: When we

> *Disk Watcher* is a RAM-resident DOS shell program with some extra bells and whistles added.

copied the TREE.COM program from the A: disk onto the hard disk and did a directory listing, everything was fine. When we attempted to run TREE, however, DOS gave us a "Bad command or filename" message. A subsequent directory listing showed that TREE.COM had been deleted.

The KILLER virus got through *Disk Watcher*'s protection with no problem. During testing with the virus simulator, the system hung when it tried to format a track on drive A:. A repeat of the test duplicated the hanging. When we ran the DOS interrupt part of the virus simulator, *Disk Watcher* passed.

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Version 2.0 of *Disk Watcher* includes two separate manuals, the second being a supplement that details new enhancements. RG Software told us that it is incorporating both manuals into a single volume with the next manufacturing run. The documentation is lucid, with illustrations of the various parts of the *Disk Watcher* shell in action.

Disk Watcher is a nice utility to have around. It seems to be extremely useful in preventing system disasters that are caused by user ineptitude or negligence. As antivirus protection, however, the program falls short in the level of ingenuity needed to foil serious virus writers. Although *Disk Watcher* is a fine file manager, don't count on it to save your system from virus attacks.—**Marc Adler**

Dr. Panda Utilities

The lead programmer for Panda Systems' *Dr. Panda Utilities* ($79.95) is the same person who brought us the CHK4BOMB and BOMBSQAD utilities some years ago. In the *Dr. Panda* collection, we get similar utilities with more-advanced features, as well as some totally new tools.

Dr. Panda Utilities includes Labtest, which allows an in-depth search of new, suspect, or unknown files for calls bypassing DOS; accepts requests to write to absolute sectors; and offers a full-screen, editable display of all embedded ASCII code. The program also includes two other utilities: Monitor, which traps dangerous write operations such as FORMAT and can optionally monitor all read/write operations; and Physical, which checks the integrity of files on your system.

Physical also watches the hidden file structure to inform you if any hidden files are created, and you can request that Monitor trap all write operations, letting through only the ones that you approve.

Dr. Panda also offers NOBRAIN, a program designed to guard against the Pakistani-Brain virus. It searches for the virus code, eradicates it, and restores the integrity of the disk.

Dr. Panda Utilities seeks to detect potential problem programs before running them and to protect critical DOS areas at all times (boot sector, partition table, and others). The program's utilities do not

Performance Tests: Virus Protection Software

All the packages we tested were monitoring programs, which are installed and remain in memory to monitor operations.

For testing with the Lehigh virus, *Certus, Dr. Panda Utilities, Flu_Shot+, Mace Vaccine,* and *Vaccine* were deemed effective. In reality, none of these packages are 100 percent effective in preventing a diskette-spread infection since they operate on the hard disk and—except for *SoftSafe*—cannot prevent infection incurred from booting with a floppy disk. Your best protection from this type of virus is never to boot from a floppy.

The packages that were effective against the Lehigh virus detected the execution of a changed file. This means they all kept some type of file-checking or statistics records. *Certus* and *Mace Vaccine* stopped operation once the infected COMMAND.COM was discovered, and *SoftSafe* would not allow access to C: from a floppy boot. *Vaccine* indicated that COMMAND.COM was modified, but its Checkup utility did not indicate that a virus was the culprit. *Dr. Panda Utilities* and *Flu_Shot+* displayed messages when the tampered COMMAND.COM was run. Although *C-4* did not pass our testing using its TSR mode, a separate command-line utility, C4ADD, did detect and correct the infected COMMAND.COM.

Software that was effective against the TSR virus was judged on two fronts. The first question was, "Did the package notify the user of the virus or prevent it from going TSR?" To detect the virus, antivirus packages monitored TSR activity. *C-4, Dr. Panda Utilities, Flu_Shot+, Virusafe,* and *Vir-X* were considered effective. *Disk Watcher* gave a "Bad command or filename" message when the infected program was run, and the TREE.COM file was erased from the disk. *Dr. Panda* was effective against the virus going TSR, but only at boot-up or on request.

Second, we asked, "Did the package notify the user that a modified program was running?" This question actually tests for the presence or absence of signature checking or integrity statistics that the software maintains on a given file. *Certus, Dr. Panda, Flu_Shot+, Vaccine, Virus Guard,* and *Vir-X* all used this feature.

For the KILLER virus, no packages prevented infection of .COM files, and none caught the Trojan horse component. Nevertheless, *Certus, Disk Watcher,* and *Virus Guard* demonstrated partial effective-

ness against the virus infecting .COM files (but not the Trojan horse component) by indicating that a changed file was being run. *Vaccine* did not catch the modified file, but it did detect NOVIRUS when it disinfected the files.

Our reviewers were sequestered in a special part of the PC Labs facility. Four 8-MHz IBM PC ATs with 30MB hard disks and 640K RAM were set up in this room. All hard disks were freshly formatted (low- and high-level) prior to testing each virus. Testing began with two known viruses (Lehigh and TSR), and one written by PC Labs (KILLER). We also ran a virus simulator that checks for protection of certain interrupts and I/O functions. The results of the virus simulator appear within the reviews, where relevant.

Lehigh Virus

Program	Effective against virus
C-4	○
Certus	●
Disk Watcher	○
Dr. Panda Utilities	●
Flu_Shot+	●
Mace Vaccine	●
SoftSafe	N/A
Vaccine	●
Virusafe	○
Virus Guard	○
Vir-X	○

●—Yes ○—No
N/A—Not applicable: *SoftSafe* does not allow boot-up from a floppy disk, which this test requires.

LEHIGH VIRUS This virus embeds code in COMMAND.COM. (Lehigh also has a Trojan horse component and a FAT-destroying ability that we did not test.)

We began by loading the antivirus program and then booting the AT from a write-protected IBM PC DOS 3.3 diskette. Next we entered a SYS C: command from the A: drive, copied COMMAND .COM from A: to C:, and recorded its date, time, and file size. We then rebooted the system with a Lehigh-infected diskette. To activate the Lehigh virus, we ran a DOS DIR command of the root directory on the hard disk. If COMMAND.COM had changed, the infection had begun.

At this point, we tested the antivirus program. Programs having checksum or integrity-statistics checking were expected to alert the user to the modification of COMMAND.COM.

TSR Virus

Package	Effective against virus	Notified user that a modified program was being run
C-4	●	N/A
Certus	○	●
Disk Watcher	○	N/A
Dr. Panda Utilities	●	●
Flu_Shot+	●	●
Mace Vaccine	○	N/A
SoftSafe	○	N/A
Vaccine	○	●
Virusafe	●	N/A
Virus Guard	○	●
Vir-X	●	●

● —Yes ○—No
N/A—Not applicable the program has no checksum or signature-checking capabilities to search for a modified program

KILLER Virus

Package	Effective against virus	Notified user of Trojan horse activity
C-4	○	○
Certus	●	○
Disk Watcher	●	○
Dr. Panda Utilities	○	○
Flu_Shot+	○	○
Mace Vaccine	○	○
SoftSafe	○	○
Vaccine	○	○
Virusafe	○	○
Virus Guard	●	○
Vir-X	○	○

● —Yes ○—No

TSR VIRUS   This virus (also known as the Israeli virus, after the place where it was discovered) alters .COM files so that they become terminate-and-stay-resident (TSR) programs when executed

Each reviewer created a directory on C: and copied the virus and test .COM files to that directory. We then entered a DIR *.COM command and recorded the dates, times, and sizes of the .COM files.

At this point we activated the antivirus program, which was optimized to protect .COM files. We were especially interested in TREE .COM, the file to be infected by the TSR virus.

We then activated the virus. This virus is itself a TSR, and an antivirus program sensitive to TSRs should have sounded an alarm. Next we executed TREE.COM, causing the copy of TREE.COM on-disk to become infected. The antivirus program should have warned of an attempt to alter the TREE.COM file. We executed DIR *.COM and recorded the dates, times, and sizes of the .COM files, verified that TREE.COM had changed, and noted if the antivirus program had displayed any messages

Then we ran TREE.COM again. If the antivirus program had checksum or signature-verification abilities, it should have indicated that we were attempting to execute a modified copy of TREE.COM. This activity was noted as well Effective programs detected TREE.COM going TSR, or the running of a modified program.

KILLER VIRUS   This virus, created by PC Labs for test purposes, infects .COM files. It also has a Trojan horse component activated by a system date of Friday the 13th. When activated, the Trojan horse function reverses the case of letters in the file VIRUS.TST, changing uppercase letters to lowercase and lowercase letters to uppercase. Two utility programs (both of which are .COM files) were also written: VIR_CHK, which determines if a .COM file has been infected by KILLER, and NOVIRUS, which disinfects and restores the KILLER-infected .COM files

Each reviewer created a directory on C: and copied the KILLER virus, VIR_CHK, NOVIRUS, and several .COM files into that directory. We then entered DIR *.COM and noted the sizes of the .COM files.

We installed and activated the antivirus program with optimizations set to protect .COM files, if applicable. We ran VIR_CHK to ensure that only VIRUS.TST itself was infected and then activated KILLER, noting any messages displayed by the antivirus program.

KILLER should have infected and added code to all of the uninfected .COM files. We executed a DIR *.COM and noted the sizes of the .COM files, then ran VIR_CHK to verify that all .COM files were now infected

To activate the Trojan horse, we changed the system date to Friday, January 13, 1989. We then executed the now infected VIR_CHK .COM file and executed TYPE VIRUS.TST to verify that the case of the letters in that file had indeed been reversed. We also noted whether the antivirus program gave any notification of the Trojan horse code

Finally, we executed NOVIRUS to disinfect the .COM files. At this point, if the antivirus program had checksum or signature verification, we noted whether it displayed a message indicating that the NOVIRUS program had been altered since the last checksum was computed.

If the antivirus program did *not* trigger during the execution of KILLER and allowed the .COM files to become infected, it was considered not effective. If the program did not detect the Trojan horse component, it was considered not effective.

automatically attempt to prevent the spread of viruses, but only try to prevent them from doing major damage.

Ideally, when Monitor or Physical reports a problem, the average user is supposed to seek out experienced help. Power users are expected to know if the problem might be significant, so the option to abort is presented.

When in doubt, users can always count on Panda Systems for competent and friendly assistance, including aid in identifying and recovering from problems. The company has put some of its expertise into the documentation as well.

When you install Physical, it maintains a database of all files that you've indicated you want checked. There are a few defaults available: COMMAND.COM; boot sector; IBMDOS.SYS (MSDOS.SYS); IBMBIOS.SYS (IO.SYS); all .COM, .EXE, .SYS, and .OVL files; and AUTO-EXEC.BAT. You can also create your own list of files, including wildcards.

With Monitor and Physical installed in your AUTOEXEC.BAT, you'll know if a recorded file has changed since the last time you rebooted your system. It is also possible to run Physical at any time to see if one of your programs has been changed.

One annoyance in the current version is that the only way to update Physical's database is to reinstall from scratch. We discovered this after installing the utilities and then adding them to AUTOEXEC.BAT.

Panda Systems says that the newest version of the program, unavailable at the

time of review, also contains TSRMON, a program that tells you if an unauthorized program wants to become resident and points out the vectors it wants to hook; Quikphys, a smaller version of Physical that can be used to test software in a specific subdirectory before and after executing the application located there; and Phys-ed, a utility for updating Physical's database.

ONE CATCH   One problem with *Dr. Panda Utilities* is that Physical is normally run only at boot time. Many users don't re-boot their systems that often and therefore lose much of the program protection that *Dr. Panda* has to offer. Ideally, *Dr. Panda* could check program files before they are loaded into memory. The Quikphys utility in the next version should be used to check applications before and after they are run, and a periodic check of the whole disk using Physical is a good idea.

Programmers will want to delete .EXE files that they are working on or use the Phys-ed utility in the next version to remove the signatures from the database, so that Physical won't complain about the files having been changed.

In testing, *Dr. Panda* stopped the Lehigh virus and was effective against the TSR virus as well. The KILLER virus got around the program, however.

You can use *Dr. Panda Utilities* for a quick line of protection on your system. It has a good degree of integrity, particularly with regular use of Quikphys or Physical. The fact that it functions without getting in your way makes it that much better.—**Noel Bergman**

Flu_Shot+

To be successful in the shareware market, all you need is a simple idea, some word of mouth, and a programmer who can keep up with the demands of users. Software Concepts Design's *Flu_Shot+* started with a simple idea: protect a computer system from invading viruses. Over time it has evolved into a polished, professional program with diverse features and options.

Under the shareware method of distribution, you can purchase *Flu_Shot+* directly from Software Concepts Design for $10, or you can download it from an on-line service (a BBS, CompuServe, PC

Flu_Shot+'s blue warning screen alerts you to a potential virus attack. Notice near the bottom of the screen that the program correctly identifies the virus it has detected as the Lehigh strain.

MagNet, and others) and pay the registration fee later. With protection schemes changing so rapidly, registered users should be prepared for a steady flow of updates.

All of the program, parameter, and documentation files are contained on the distribution disk or, in the case of a download, in one .ARC file. Installation begins with copying the files to a floppy or hard disk and printing the documentation. Reading the documentation is very important with *Flu_Shot+*. Default parameters are included in a file called FLUSHOT .DAT, but even these defaults need to be edited to function properly. The final step is to copy the FLUSHOT.DAT file to the root directory of the C: drive.

Flu_Shot+ is activated by typing FSP at the DOS prompt. The FSP command may also be placed in your AUTOEXEC .BAT file if you want *Flu_Shot+* to be activated every time you boot your system.

Many options can be set by adding commands to the FLUSHOT.DAT file. These commands allow you to write-protect, read-protect, and checksum-protect files as well as bypass protection for certain files and allow some friendly TSR programs to load without interruption.

Write and read protection can be specified for a particular file or a group of files using the standard DOS wildcard characters, ? and *. For example, P*.COM write-protects all .COM files. You can use multiple commands to protect as many
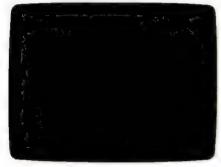
files as necessary. The Exclude command allows you to override previously defined restrictions and grant unlimited access to a file or group of files.

To activate the checksum feature, a dummy checksum is placed in a command line in FLUSHOT.DAT. *Flu_Shot+* will display a warning containing the valid checksum. The FLUSHOT.DAT file must be edited again to replace the dummy checksum with the correct number.

The default FLUSHOT.DAT file contains commands to checksum-protect COMMAND.COM, IBMBIO.COM, and IBMDOS.COM. If the default file is used

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and the proper checksum numbers are not inserted, *Flu_Shot+* will flash a warning about these files every time it is invoked. If you haven't read the documentation, you could get quite a scare the first time you run *Flu_Shot+*.

The creation and editing of the parameter file is not difficult, though a user-friendly configuration routine that produces the parameter file from simple user input would be a better approach.

With *Flu_Shot+* installed on your system, you can still do what you like, but there is the constant feeling that someone is watching your every move. It's for your own protection, but it's unnerving nonetheless.

You are constantly reminded of *Flu_Shot+*'s presence by a plus sign (+) in the upper-right-hand corner of your screen. This indicator can be turned off by hitting the Ctrl key three times. Many users will welcome the reassurance, however, and leave it on.

Most application software doesn't try to create or alter the types of files that *Flu_Shot+* is protecting, so operation is smooth. If you attempt to run an operation on a protected file, format a disk, or load a TSR that was not entered in the FLU-SHOT.DAT file, *Flu_Shot+* will warn you of possible danger by popping up a window in the middle of the screen and beeping. You are then given the choice of allowing the access, disallowing it, or allowing all subsequent accesses used in that command. The last option is handy for procedures requiring multiple file accesses, like COPYing several files at a time, and avoids having the message window pop up repeatedly.

Like most of the other programs we tested, *Flu_Shot+* couldn't control the KILLER virus, but it did sound the alarm when both the TSR and the Lehigh virus were introduced.

Be aware, however, that *Flu_Shot+* does not pop up properly in graphics mode. After an attempt to format a disk in *Microsoft Windows*, the system had to be rebooted. *Flu_Shot+* should be disabled by hitting the Alt key three times before entering a graphics application to avoid this problem.

Despite some small inconveniences, *Flu_Shot+* offers extensive protection from the dangers that may be encountered in a computer system, whether they be user blunders or attacking viruses.
—**Stuart R. Greenberg**

Mace Vaccine

Before data restoration programs arrived, you could do some pretty serious damage to your own system if you weren't careful. PC users spent countless sessions with *The Norton Utilities* resurrecting important files that had been accidentally erased. Then along came *Mace Utilities*. It was hard to believe that you could actually format your hard disk or wipe out your FAT and still restore the data to its original state. It wasn't long before "Are you running *Mace*?" became the number one question on many PC support hotlines.

Mace Utilities is an excellent cure, but it's useful only after the damage has occurred. For those of us who want to prevent the accidents from happening, Paul Mace Software has another solution: *Mace Vaccine*.

Mace Vaccine ($20) can function at two levels. The first guards against unauthorized or accidental access to system files, including COMMAND.COM, and system areas such as the boot sector and the FAT. At the second level, the program guards against unauthorized disk access by programs such as FORMAT, CHK-DSK/F, DEBUG, disk reorganizers, and disk sector editors such as *The Norton Util-*
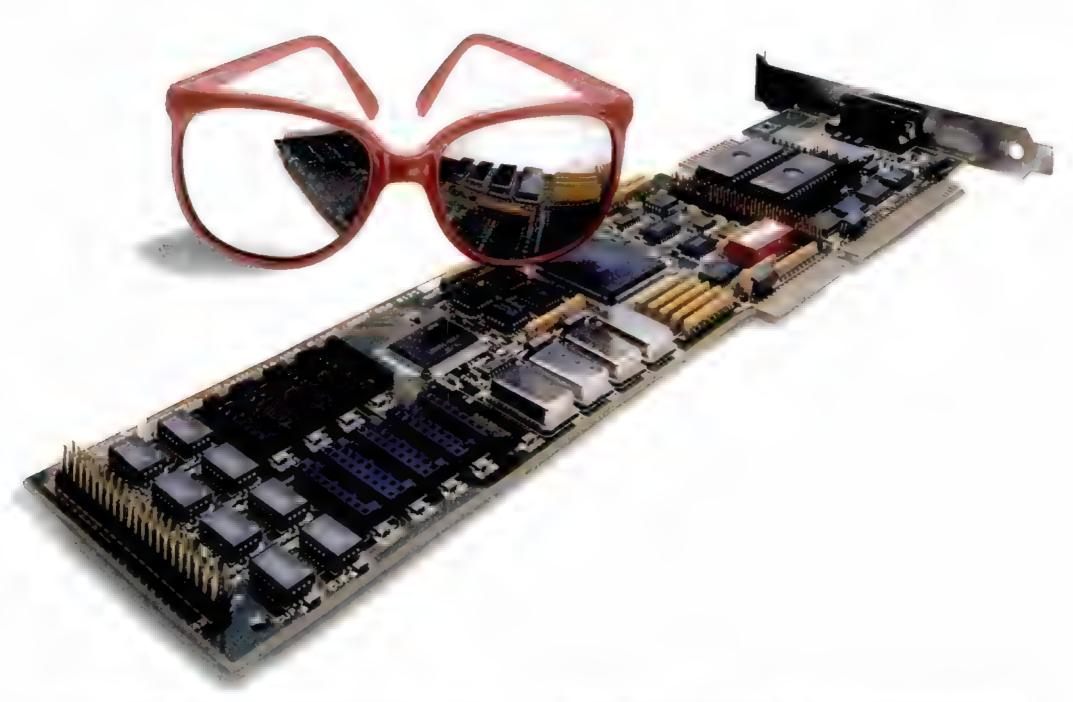
ities and *PC Tools*. Entering VACCINE at the DOS prompt or in the AUTOEXEC.BAT causes *Mace Vaccine* to default to Level 1. Adding a level number after the command—VACCINE 2, for example—loads *Mace Vaccine* at that level. *Mace Vaccine* can also be disabled or enabled at any time by issuing the Vaccine Off or Vaccine On command.

Although *Mace Vaccine* is billed as an antivirus program, testing showed that it gave limited protection in this regard. A virus that attacks before *Mace Vaccine* is loaded can do its damage without detection because the program has no way of knowing that the damage occurred. A future re-

The Mace Vaccine *warning window has popped up in response to the user's attempt to format a floppy disk (the FORMAT command is visible on the black part of the screen). The warning screen asks for confirmation of the command.*

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CIRCLE 127 ON READER SERVICE CARD

lease with checksum capability will alleviate this problem, but for now it is a serious limitation.

Mace Vaccine consists of a floppy disk containing just one file and a two-sided card giving information about viruses on one side and simple instructions on the other. Installation is as easy as copying the lone file to your hard disk and executing it. For truly novice users, the program can even be run off the floppy disk drive.

Fiddling with disk sectors and unpredictable bugs can be more of an enemy to valuable data than a virus, so we launched an attack on the test system to gauge the protection that *Mace Vaccine* offered against these problems. As advertised, attempts to format a disk or update disk areas through a sector-editing program caused a box to open at the top of the screen asking for authorization to perform the attempted function.

Many users have copied all the files on a floppy disk to the root directory of their hard disk only to find that an old version of COMMAND.COM was inadvertently copied over as well. Later, the system refuses to boot up and sends the user on a hunt for a copy of DOS on a floppy disk to restore the file. We simulated this situation by copying a different file over the current COMMAND.COM. Sure enough, *Mace Vaccine* attempted to save the system, and we told it not to allow the procedure to take place. The surprising result, however, was that the disk's COMMAND.COM had been destroyed.

During this operation, *Mace Vaccine* didn't just pop up once. Since, in this case, it interrupted the function by simulating a disk error, it popped up once for each time

the system retried the disk access. Five times *Mace Vaccine* asked if we wanted to allow COMMAND.COM to be hurt, and five times we said no. The ubiquitous "Abort, Retry, Fail?" followed and we said, "Abort," but it was too late. According to Mace technical support, a pointer to the COMMAND.COM file was destroyed in spite of the fact that the file's data was protected.

This is a crucial flaw, because there is no such thing as partial protection. Either your system is safe or it isn't. With the current version of *Mace Vaccine*, you aren't quite sure.—**Stuart R. Greenberg**

SoftSafe

SoftSafe's chief functions are to furnish hard disk password protection, data-file encryption, and keyboard locking. The $99 program from Software Directions is not really a full-fledged antivirus application, as it doesn't make any attempt to prevent virus programs from going TSR. Nor does it prevent viruses that do so on a *SoftSafe*-protected system from infecting other files. Further, any virus that already exists on a disk will not be caught by *SoftSafe*'s antivirus mechanisms.

The *SoftSafe* antivirus system is a combination of two programs. The first is a part of the actual *SoftSafe* software, and is designed to protect four critical files—IBMBIO.COM, IBMDOS.COM, COMMAND.COM, and FORMAT .COM—at boot-up time. The second is a utility program called VSCHECK.EXE,

> Either your system is safe or it isn't. With the current version of *Mace Vaccine*, you aren't quite sure.

which examines and monitors all system-executable (.EXE, .COM, and .OVL) files for changes. Because *SoftSafe* checks files only at boot time, and because it does not guard against resident viruses, *SoftSafe* did not fare very well in testing.

SoftSafe assumes that prior to installation the system can be considered clean. It then provides several measures of defense. First, because *SoftSafe* is 85 percent a data-encryption and hard disk password-protection program, all access to the hard disk is prohibited unless you boot from the hard disk and issue a password. *SoftSafe* loads itself as a device driver and installs itself before any executable programs can run.

This arrangement stopped the Lehigh

When a new executable program is detected, VSCHECK, one of SoftSafe's *subprograms, informs you of the fact and suggests that you add the program to the detection file, where it will be compared to its signature each time it runs.*

■ ANTIVIRUS SOFTWARE

virus, whose existence depends on booting up a machine from a floppy disk containing an infected copy of COMMAND .COM.

SoftSafe places a good deal of emphasis on protecting critical files. It creates a single, specially encrypted file made up of the four vital root files. The file is given a unique name guaranteed to be different on all machines *SoftSafe* runs on. The file is then hidden, making access to it very difficult.

When a *SoftSafe*-protected hard disk is booted, *SoftSafe* checks the four critical files. If it finds any changes, it informs the user and asks if it should replace the contaminated file with a noninfected copy. If told to do so, *SoftSafe* then extracts a clean copy of the file in question from its encrypted file.

Software Directions calls *SoftSafe*'s VSCHECK.EXE utility a noncritical virus-detection program. When the program is run for the first time, the system must be clean. The program uses a proprietary encryption/checksum scheme to maintain a record of all executable files on a given drive. Other drives can be protected by running the program once for each specific drive. After the clean record has been made, VSCHECK will monitor all executable files for any changes.

If a program is found to have changed, *SoftSafe* issues a warning that the file may be infected and suggests that the file should be deleted. This system obviously will not prevent files from becoming infected by viruses that enter the system after boot time, but it will do a fairly good job of keeping you informed of possible invasion.

Because *SoftSafe* loads as a device driver rather than as a TSR, it doesn't conflict with any other software. The documentation is brief but to the point; it makes very clear what is going on at any given time.

Once *SoftSafe* is installed, you will need to enter a password to access your hard disk. *SoftSafe* allows up to eight passwords; these can be used by one or more people. Other features include an excellent data-encryption scheme and the ability to lock the keyboard. The program will do a good job of protecting sensitive data.

Quibbles? A few. There is no hardcopy documentation on VSCHECK. In fact, the manual doesn't even mention the program. You would need to actually examine the contents of the diskette on which the software comes to find VSCHECK and its documentation file. I'm not sure if VSCHECK was included too late in the game to get it into the manual for the current release, but it most definitely belongs there. It is an essential part of *SoftSafe*'s antivirus protection scheme.
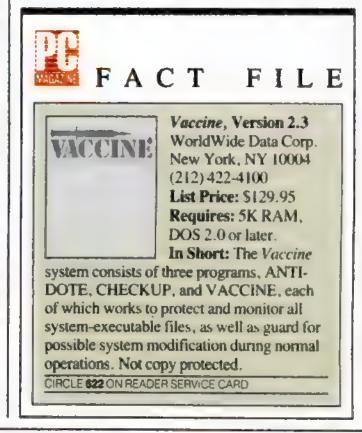
As a data-encryption and hard disk password-protection program, *SoftSafe* is recommended. As a virus killer and TSR stopper, it isn't. If simply being able to keep track of possible contamination of executable files is an adequate antivirus measure, then *SoftSafe* is worth a close look. If data encryption and password protection are a concern as well, then it most definitely deserves consideration.—**Tony Rizzo**

Vaccine

WorldWide Data Corp.'s *Vaccine* ($129.95) is an interesting collection of three programs that try to attack viruses from different directions.

First, *Vaccine* checks for viruses that may already be on the system by running ANTIDOTE. Every executable (.EXE, .COM, and .OVL) file is inspected, and any program that ANTIDOTE thinks is infected is flagged. Next CHECKUP is run. This program uses an encrypted checksum algorithm to create a file containing a record of the current state of every executable file. When subsequently run, any file that

PC **F A C T   F I L E**

VACCINE

Vaccine, Version 2.3
WorldWide Data Corp.
New York, NY 10004
(212) 422-4100
List Price: $129.95
Requires: 5K RAM,
DOS 2.0 or later.
In Short: The *Vaccine*
system consists of three programs, ANTIDOTE, CHECKUP, and VACCINE, each of which works to protect and monitor all system-executable files, as well as guard for possible system modification during normal operations. Not copy protected.

CIRCLE **622** ON READER SERVICE CARD

■ ANTIVIRUS SOFTWARE

CHECKUP, part of the Vaccine routine, records the current state of all executable files, and the information is used later to compare the executable file to itself to make sure no changes have been made. This file is the last of 238 to be checked.

has changed will be flagged. CHECKUP loads its entire record file into memory when running. It can store information on approximately 1,300 files. A greater number of files will require CHECKUP to build more than one record file.

Finally, VACCINE is a TSR that tries to prevent viruses from installing themselves. Once VACCINE is loaded, it sounds a series of beeps when any program goes TSR, and it asks if you want to let the program run or if the system should be rebooted.

ANTIDOTE and CHECKUP come with several options that allow for specific directories to be searched, for quiet-mode operation (no messages output to screen), and for help screens. In addition, CHECK-UP has options that tell it what output file to create or what input file to use in comparing files.

The *Vaccine* programs seem to furnish adequate safeguards, but they have some problems. Though the programs appear to work most of the time, as our lab tests show, they don't work all of the time.

The Lehigh virus, for example, was not detected by ANTIDOTE. A virus as famous as this clearly should have been recognized. On the other hand, CHECKUP did report that COMMAND.COM had changed, indicating that immediate action to supply a clean copy should be taken. To test VACCINE, we left the infected COM-MAND.COM on the system and performed the DIR command on drive A:, which contained a clean copy of COM-MAND.COM. The clean copy immedi-

ately became infected, indicating that VACCINE was not effective in this case.

When we tested against the TSR virus, ANTIDOTE indicated that several files were infected. CHECKUP reported that several new files had been installed. We left the files on the system. When executing one of the infected files, VACCINE reported that a program was modifying the system and asked whether this was OK or if a reboot was in order.

We let the virus install itself. Once the TSR virus goes TSR, it infects any executable file when that file is run. When the

> **The *Vaccine* programs seem to furnish adequate safeguards, but they have some problems.**

DOS TREE command was executed, VACCINE did not catch the TSR infecting TREE.

The Trojan horse component of the KILLER virus bypassed ANTIDOTE and CHECKUP because its ill effects were manifested only when certain programs were run after boot time and when the date changed. The burden of capture clearly lies with VACCINE under these circumstances. Unfortunately, the KILLER virus

was not caught. Ironically, VACCINE did catch a program—NOVIRUS—that was specifically intended to disinfect the system of the KILLER virus.

Finally, although VACCINE caught the very first action taken by the virus simulator (in fact, a harmless read operation), it caught absolutely nothing else (no direct disk writes, for instance).

The combined use of the three programs was sufficient to detect both the Lehigh and TSR viruses. To do so required careful and accurate running of all three programs. Since many viruses install themselves after boot time, however, it is possible that a good many programs can become infected before the next reboot of the system. It is conceivable (though improbable) that so many files might become infected that even if each of them were reported, the task of cleaning up might be futile.
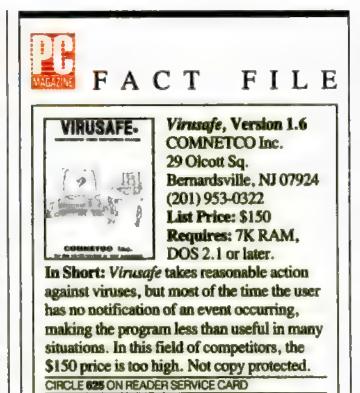
Vaccine gets along with TSR applications and most standard programs such as *Lotus 1-2-3*, *dBASE IV*, and *Crosstalk*, but it had all sorts of problems with *Microsoft Windows*. *Windows/386* could not install itself, and the entire system hung, with VACCINE reporting a system modification but rendered unusable. A hardware reset was necessary.

Clearly the great burden of protection falls on the VACCINE utility. Unfortunately, VACCINE does not appear to be sufficiently robust to earn confidence. A potential user will have to consider what is or isn't enough protection.—**Tony Rizzo**

Virusafe

Virusafe from COMNETCO ($150) consists of three major parts, two of which are passive in nature: the virus diagnostics program and the program integrity checker. The third is run as a TSR (memory-resident program). All programs can be run whenever the user chooses, but the best method is to run the *Virusafe* protection commands at boot-up from the AUTOEXEC.BAT file.

The virus diagnostics program (VC.EXE) is executable from the command line or from a .BAT file or another program. Its purpose is to take a snapshot of your system's memory and scan it for a virus. This is a useful program to have as

your last AUTOEXEC.BAT line during system boot-up. It allows you to check your PC's memory after you've loaded any special programs or TSRs that you normally load at boot-up and to detect if any have been replaced by viruses. Of course, you work under the assumption that VC itself has not been toyed with, but if you can live with keeping a backup copy of *Virusafe* and having it handy every time you reboot, it could be worth your while. Remember that the floppy disk must be kept secure as well.

The next piece of *Virusafe* is PIC, the program integrity check. This nifty little program is very easy to use and allows you to flag individual files for viruses whenever you use the command PIC /N. For instance, you may want to have specific files like COMMAND.COM checked for violations. PIC will record various aspects of the flagged files, such as size, as well as its own checksums.

VS.EXE, the memory-resident portion of *Virusafe*, is responsible for detecting viruses and preventing them from infecting your system in real time (as they happen). Unfortunately, *Virusafe* is so diligent in its prevention that it stops just about everything.

There are two problems here. First, even though *Virusafe* is supposed to prevent a virus attack, it almost never alerts the user. This doesn't seem right; viruses should be prevented, but they should also be announced. For instance, in our testing

we were only able to make VS.EXE detect that some other program was launching a TSR of its own. This is an important concern, but why stop there?

The second problem is that the documentation for *Virusafe* fails to point out that programs that need to act in special ways may not function correctly with *Virusafe* loaded. This can present a serious drawback.

The result is that *Virusafe*'s memory-resident capabilities are limited, especially when compared to some of the other antivirus programs on the market. With products from other vendors, you are typically confronted with pop-up windows informing you of a potential problem or illegal access to a file or an area of the disk. In addition, you are usually given two choices: to allow the problem or access to occur, thereby letting the program continue on its way, or to abort or prohibit the suspicious activity so that illegal access is denied and the spreading of the virus can be halted. It would be nice if *Virusafe* gave you this option.—**Greg Comeau**

Virus Guard

IP Technologies' *Virus Guard* ($24.95) builds a simple and smooth line of defense against computer viruses and other forms of program file corruption.

Virus Guard's philosophy is simple: files don't become corrupted on their own—something has to corrupt them. Hence, *Virus Guard* prevents corrupted
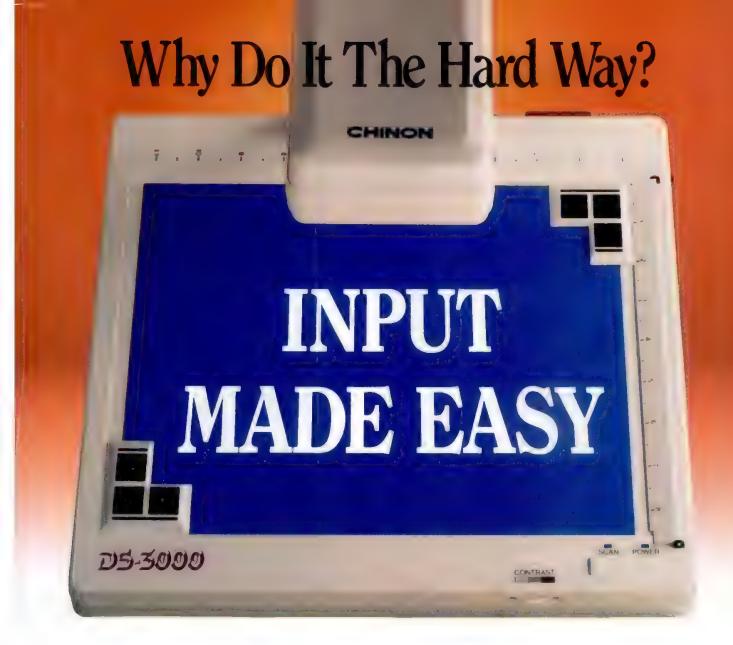
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programs from running, keeping questionable code from making its way to the CPU.

What *Virus Guard* does not do is monitor reads and writes or protect files from viruses that may already exist and have been inadvertently approved. But *Virus Guard* will prevent those viruses from spreading, since each newly infected program can be prevented from running.

The program comes in two parts. SIGGEN is used to generate and maintain the

> **If you were to combine *Virus Guard* with *Dr. Panda Utilities*, you would have a very complete and protective package at a reasonable price.**

signature file. RAMWATCH is a resident application that checks programs against their signatures and allows only the ones that pass to run in your system. Each drive in your system gets its own signature file.

Once SIGGEN has been used to create the signature files and RAMWATCH has been loaded, a program is compared against its signature each time it is loaded. For a new program that doesn't have a signature, you are given the option of adding it to the database, running it without adding it, or not running it.

If a file's signature has changed, you can either record the new signature, disable signature checking, or prevent it from running. The ability to turn off signature checking is very useful for programmers who change their code often and find most other programs of this type to be too obtrusive.

When installed at boot time, RAMWATCH does check the boot sector and the three critical DOS files, but it is otherwise just an exceptionally user-friendly (and quick) program authenticator.

In antivirus testing, *Virus Guard* had some success against the KILLER virus; it
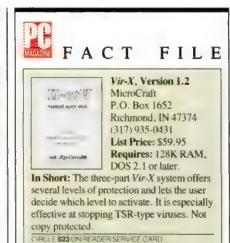
also detected the Lehigh virus but did not protect against it. The TSR virus got around *Virus Guard* and infected the disk as it did with most of the other programs.

If you were to combine *Virus Guard* with *Dr. Panda Utilities'* TSRMON (which detects and details any programs that want to become resident—a favorite trick of virus writers) and Monitor (which prevents serious damage to DOS areas and can trap read/write operations entirely), you would have a very complete and protective package at a reasonable price.

For ease of use alone, that combination would be my personal pick, but at $24.95, *Virus Guard* by itself is a steal. It doesn't do everything, but it's effective at what it does.—**Noel Bergman**

Vir-X

The $59.95 *Vir-X* system by MicroCraft consists of three distinct programs. The first, Protek, is a full-screen directory listing program that lets you choose files that the second program, Detek, will monitor for virus activity. Protek allows you to set a protection level ranging from 0 to 9, with 9 supplying the most protection. When you choose a file for protection, a checksum is calculated using every nth byte of the file, where n is 10 minus the protection level. After you've chosen all the files you want to monitor, you must save the Protek list to disk, and the procedure must be repeated for every disk drive you want to protect. This may be a cumbersome process if you need to protect files that you

have decided to keep on a floppy disk.

Detek examines all of the programs in the Protek list for possible changes by calculating a new checksum for the file and comparing it with the checksum stored with the Protek list. You must change to a specific drive in order to run Detek on that drive's files, a disadvantage if you have set up multiple logical drives on your hard disk.

The third program in the set is perhaps the most useful. DiskLok is a TSR program that monitors your system for attempts to access the disk's boot sector, hidden system files, and executable files. In addition, it includes a feature that monitors RAM for modifications to DiskLok itself. If virus activity occurs, DiskLok will pop up a warning message and prompt you

The DiskLok function of Vir-X *has caught the PC Labs virus simulator in action and has added the information that the targeted file is a boot record sector.*

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■ ANTIVIRUS SOFTWARE

to either abort the operation or let it continue. You can also choose a help screen that details the suspected viral activity, giving experienced users a chance to track the virus down. Another feature of DiskLok, TSRLok, will halt the system and send a warning if any program tries to install itself as a TSR.

Vir-X comes on a single diskette and is accompanied by a 23-page manual. The first nine pages give a tutorial on viruses and preventative measures that a user can take to prevent an attack—a nice touch for people who are puzzled about how viruses work and what kinds of damage they can do. The remaining pages deal with the installation and use of the three programs that comprise *Vir-X*. The manual is concise but clear, and you'll be able to peruse it quickly and come away with a complete understanding of the system.

PERFORMANCE   *Vir-X* did not detect the Lehigh virus, nor did it stop the KILLER virus. It did, however, do a good job

on the TSR virus. With TSRLok enabled, *Vir-X* caught the TSR virus's attempt to install itself as a TSR and halted the system. Without TSRLok on, *Vir-X* caught the attempts by the TSR virus to write to the TREE.COM file.

When DiskLok is first installed, the

> **MicroCraft's *Vir-X* did not detect the Lehigh virus, nor did it stop the KILLER virus. It did, however, do a good job on the TSR virus.**

TSRLok feature is disabled by default. You have to enable it manually by pressing a combination of hotkeys. Since it is easy to forget to enable TSRLok, it's also easy for TSR viruses to get through *Vir-X* and launch an attack.

Vir-X is one of those programs that seem to have been born practically overnight in response to the current virus phenomenon. It performs the system-monitoring functions well, but the user interface could be improved to allow a more seamless method of testing for modified files. With some small tinkering, *Vir-X* could find a spot near the top of your software pile.—**Marc Adler**   **PC**

Marc Adler is the president of Magma Systems, a New York City–based consulting firm, and the developer of the ME text editor. Noel Bergman is a Philadelphia-based computer consultant specializing in software development. Greg Comeau is chief executive officer of New York–based Comeau Computing, an independent software and development firm specializing in programming tools and training for the Unix, C, and C++ environments. Stuart R. Greenberg is a senior programmer at PC Magazine Labs. Tony Rizzo is a freelance writer who focuses on computer-related topics.

PC **E D I T O R ' S**
C H O I C E

- **Flu_Shot+**
- **Certus**

Our testing proved that no single program can deliver 100-percent protection from virus attacks on your machine, but many put up lines of defense that can do some good and even save you from your own mistakes. You certainly can't go wrong investing $10 in a copy of Flu_Shot+. It's as complete and effective as other, more-expensive programs in a category of software where more money doesn't necessarily buy you more functionality.

At the other end of the spectrum is Certus, a $189 program that performed above average in testing and offers virus protection as but one of 34 utilities designed to keep your system safe from a variety of attacks, disasters, and acts of foul play.

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DISKLESS
LANSTATIONS

Diskless LANstations sound like such a good idea, but acceptance of these products, in terms of sales, hasn't been great. Novell, which relabeled two different types of imported LANstations and sold them at aggressive prices, quit selling them as part of a general cutback in hardware marketing. And while 3Com, a company producing one of the premier LANstations, says that its 3Station/2E has "exceeded sales goals," it's clear that people aren't waiting in line for these machines.

A part of the sales problem is educational. Many potential buyers don't understand how these little PCs work and don't appreciate their advantages. Another part of the sales problem is cultural. Early PC en-

Though they haven't yet captured the imaginations of local area network designers, diskless LANstations offer size and security advantages that shouldn't be ignored.

thusiasts share the feelings of *PC Magazine* columnist John Dvorak, who spurns LANstations because of the centralization and dependency they create.

Now, however, the time of acceptance for these products may be here. The pendulum is swinging, and PC enthusiasts are being overcome by hard-nosed data processing managers who know it isn't necessary for every computer user to be a self-actualized DOS guru. An increasing number of system managers see a standard PC as a large, hot, noisy, and expensive tool sometimes used by unscrupulous people to steal valuable organizational data.

As a piece of office furniture, a PC, whether networked or not, is a total flop. It takes up a lot of space, puts out too much heat and noise, and comes with a hard disk that can sound like a coffee grinder.

A networked PC also doesn't score well in the area of security. Unless you maintain complex sets of passwords and permissions, anyone with access to a network can copy a megabyte of data onto a diskette and take it out the door. Client lists, mailing lists, balance sheets, and market research reports are easier to steal on a nondescript floppy than in printed form.

LANstations overcome these drawbacks of networked PCs while providing good performance, dazzling video displays, and low prices.

Any company that manufactures PCs can turn out a LANstation by leaving out the drives and plugging the hole in the cabinet. For the purposes of this review, we looked at machines using at least an 80286 or 80386 processor and with a distinctively small footprint on the desk. These criteria cut out a lot of 8086-based machines that are available at slightly lower prices.

WHAT IT IS   A LANstation is a complete PC with its own CPU, high-quality video display, and RAM, but without local disk drives. Consequently, it can be smaller, use a less expensive power supply, and operate without a fan. It also doesn't provide a path for important data to walk out the door.

A LANstation is not the same thing as a terminal attached to a mini or mainframe computer. Terminals only present screens and accept keystrokes. The programs people use through terminals run under a mul-

titasking operating system in a shared processor using shared memory. Each LANstation, on the other hand, runs programs in its own on-board and dedicated processor and memory.

The majority of terminals are monochrome devices. The few color/graphics terminals on the market must have special coaxial or fiber-optic connections to the

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■ Most LANstations have a full complement of parallel and serial ports built into the main circuit board for printers and modems.

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host. In contrast, LANstations can have full VGA/EGA capabilities.

A LANstation connects to a network file server through a traditional media-sharing local area network like Ethernet, StarLAN, or ARCnet. DOS and all the program and data files used by the LANstation come from the server over the network, and the programs execute in the local CPU and RAM of the machine.

Each unit contains a special ROM, either on the motherboard or on the separate network interface card, if one is used, that gets the initial DOS boot from the server. A special file installed on the server contains the hidden files, CONFIG.SYS, COMMAND.COM, and other files the workstation needs to start.

Most LANstations have a full complement of parallel and serial ports built into the main circuit board. You can use printers and modems attached to the LANstation and also use shared printers and modems attached to a server on the network.

FLEXIBLE OR LOADED   There are two philosophies reflected in LANstation design. The first type of design stresses flexibility. These products are essentially a motherboard in a small box. They let you mix and match the video, I/O, and network

interface cards to meet your needs and budget. However, you also have the challenge of resolving conflicts of DMA and interrupt channels, memory addresses, and other expansion-related problems.

The second design scheme we call "no user-serviceable parts inside." In these units everything, including the network adapter, is integrated into the main circuit board. Typically you get a full complement of I/O ports and are spared the problems of integration, but you have to take what you get. The 3Com 3Station/2E and the Earthstation-IIe are the archetypes of this philosophy.

WHAT THEY COST   Because floppy disk drives are relatively inexpensive, the economic advantages of diskless workstations over standard PCs aren't great. The average full retail cost to put a diskless LANstation, complete with I/O and video outputs, on the network is about $1,700. This outlay will buy you a 10-MHz 80286 processor and a megabyte of RAM. You can shop around and pay $1,400 to $1,800 for a similarly equipped AT clone, but you will then have to add $200 to $400 for a network adapter card. So, while using LANstations will save you some money, they aren't exactly cheap.

VULNERABILITY   One strong warning must be included in any evaluation of these diskless systems. If all workstations rely on centralized shared disk drives to boot, then the entire network can be put out of service by one blown fuse or by one faulty drive. If standard PCs are used as workstations and the server goes down, people can normally fall back on local drives to do some work, but if a LANstation's only server fails, no work is done.

If you rely on diskless LANstations, then you should strongly consider buying an uninterruptible power supply and a good tape backup system for the server. These devices are good investments for any LAN, but they pay extra dividends when LANstations are on-line. LANstations aren't for everyone, but if you worry about the security of your data or are tired of sharing a small office with a hot and noisy PC, then you'll be surprised what a good alternative these machines can be.
—**Frank J. Derfler, Jr.**

ADVANCED LOGIC RESEARCH INC.
ALR VIP 20386DL

The ALR VIP 20386DL is different—and in this case different means powerful, upright, and unique. The VIP 20386DL is the only 386-based LANstation we could get our hands on (we had several promises, but few deliveries). It is also different because it sits upright, not horizontally as all the other LANstations do. The VIP 20386DL resembles a high-tech toaster as much as it does a very powerful PC.

The toaster analogy holds true even when you take the top off the machine. It is literally a box of slots (8½ by 5 by 16 inches HWD) that can be anything you want it to be. The heart of the VIP 20386DL is a five-slot backplane and ALR's own CPU card carrying an 80386 processor that runs at a fast 20 MHz.

One serial port is integrated into the ALR's motherboard. Aside from that, you deal the cards. If you add a video card and a network adapter card, the VIP 20386DL is a small and fast LANstation with two slots free for more I/O ports or a modem. The slots have standard spacing between them and standard-size rear openings. You won't see the squashed conditions we found in some of the horizontal LANstations.

The VIP 20386DL's 65-watt power supply will carry both a floppy disk and a hard disk. There is an integrated floppy-

and-hard-disk controller on the backplane, so if you want to add a hard disk to the VIP 20386DL you can keep the security of a diskless system while gaining some independence from server failures.

The price you pay for 386 processing and a heftier power supply is a fan. The VIP 20386DL's fan sits right in the front of the unit, but even from this disadvantageous position it makes very little noise. In our system the whine of the VGA video board (not ALR's product) was by far louder and more irritating than the noise from the fan.

The configuration of the VIP 20386DL's CPU card lets you add up to 16MB of RAM, but only in specific amounts and only by installing a daughterboard that steals space from an adjacent expansion slot. The motherboard comes with 1MB of RAM. Unfortunately, the Chips and Technologies chip set used in the VIP 20386DL does not let you use the memory between 640K and 1MB, so it is lost. As soon as you want to go above 640K, you must use the unique ALR RAM PAC expansion cards. RAM PACs can use either 256K or 1MB SIMMs (single inline memory modules), so you jump from 640K to 640K basic plus 1,024K of extended memory in the first expansion. Other jumps take you from 2 to 4, from 4 to 8, from 8 to 10, and from 10 to 16MB.

While adding a full load of memory leaves room for only a short card in the adjacent slot, the three remaining slots are full length if no floppy disk drive is installed.

The ALR motherboard has room for a math coprocessor, and the system uses a Phoenix ROM BIOS, Version 1.10.02C.
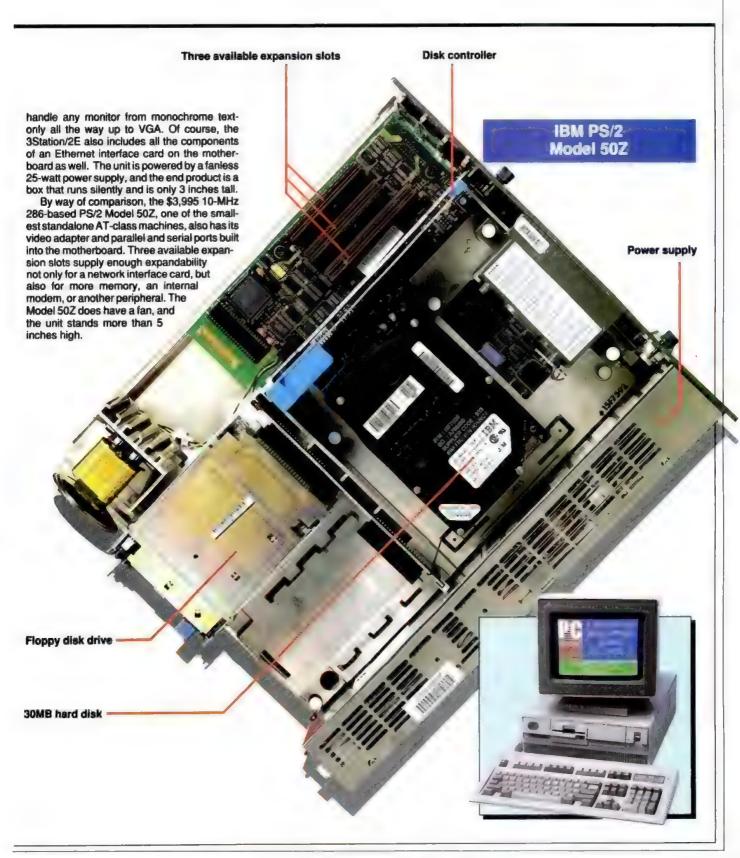
The ALR keyboard is an Enhanced-style 101-key design with the function
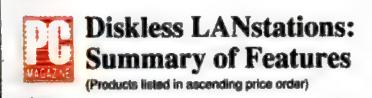
> ■ If you need 386 processing power, the ALR VIP 20386DL is a flexible and fast alternative to the behemoths that you have probably considered.

keys along the top and the ability to put the Ctrl key back next to the A, where *WordStar* users will undoubtedly want it.

The VIP 20386DL is flexible and fast. If you need 386 processing, it is an excellent alternative to the behemoths that you have probably considered. As a LANstation, it has everything including the flexibility to work with any type of network interface card and to carry an internal hard disk drive.—**Frank J. Derfler, Jr.**

ALR's VIP 20386DL breaks new ground with its unique, vertically designed case, its powerful 20-MHz 386 processing capabilities, and its five-slot architecture, which allows it to be one of the most flexible LANstations on the market.

Photographs: Thom O'Connor

Inside a Diskless LANstation

Network interface connector

Parallel port

A diskless LANstation, like the $2,495 3Com 3Station/2E, small and basically unexpandable by definition, has none of the expansion slots that a similarly sized standalone machine like the IBM PS/2 Model 50Z does. Therefore, a LANstation packs all its logic onto its motherboard.

That logic includes the contents of perhaps three normal PC expansion cards, all jammed into custom VLSI ASICs (application-specific integrated circuits). Along with the 10-MHz 80286 processor and provisions for an 80287 math coprocessor, the 3Station/2E motherboard contains 1MB of RAM (there is room for an additional 4MB using 1MB SIMMs) and serial and parallel ports.

The motherboard also includes a built-in 16-bit VGA adapter that can

3Com 3Station/2E

Network ASIC

Network

CPU

Video

RAM

80286 processor

Serial port

Video ASIC

Power supply

Three available expansion slots

Disk controller

handle any monitor from monochrome text-only all the way up to VGA. Of course, the 3Station/2E also includes all the components of an Ethernet interface card on the motherboard as well. The unit is powered by a fanless 25-watt power supply, and the end product is a box that runs silently and is only 3 inches tall.

By way of comparison, the $3,995 10-MHz 286-based PS/2 Model 50Z, one of the smallest standalone AT-class machines, also has its video adapter and parallel and serial ports built into the motherboard. Three available expansion slots supply enough expandability not only for a network interface card, but also for more memory, an internal modem, or another peripheral. The Model 50Z does have a fan, and the unit stands more than 5 inches high.

IBM PS/2 Model 50Z

Power supply

Floppy disk drive

30MB hard disk

PC MAGAZINE
Diskless LANstations:
Summary of Features
(Products listed in ascending price order)

BASIC CONFIGURATION INCLUDES	Racore LANstation S20 Racore Computer Products Inc. $979	PC NCR 3390 NCR Corp. $1,043	DWS/286 Network Innovations Corp. $1,095	Unisys Personal Workstation[2] Series 300 Unisys $1,305	Racore LANstation SL60 Racore Computer Products Inc. $1,379
RAM	512K	640K	512K	640K	512K
Total number of slots	2	2	4	3	2
Available slots	1	1	2	2	1
Power supply (watts)	80	80	60	114	80
Reset switch	●	●	○	●	●
Fan	●	●	○	●	●
SPECIFICATIONS					
Dimensions (HWD, in inches)	2.75 x 15.7 x 15.5	2.75 x 11 x 15.3	3.5 x 15 x 15.5	4 x 15 x 15.7	2.75 x 15.7 x 15.5
Processor type	80286	80286	80286	80286	80286
Clock speed	10 MHz	6/10 MHz	8/12 MHz	8/10 MHz	12 MHz
LAN card	User-supplied	User-supplied	User-supplied	User-supplied	User-supplied
Video card	User-supplied	Integrated EGA and MCGA	User-supplied	Integrated mono, CGA, and EGA	User-supplied
Warranty	1 year	1 year	1 year	1 year	1 year
BIOS version	Quadtel 1.03	NCR 4.6	Award 3.03	Phoenix 1.7C	Award 3.03

PC —Indicates Editor's Choice ●—Yes ○—No

CORMAN TECHNOLOGIES INC.
ATlantis

The creative minds of Canada's Corman Technologies have come together to bring the network community the compact ATlantis workstation, retailing for $1,995. The dimensions of ATlantis are not much bigger than those of a small briefcase, but it is loaded with video and I/O ports and offers further expansion capability.

The 80286 motherboard of the ATlantis runs at 10 MHz and has room for an optional 80287 math coprocessor. The unit includes an internal ARCnet network interface adapter card, but the ARCnet card can be disabled, allowing the use of a different network card. According to the company, a model with an internal Ethernet adapter is in the works.

The ATlantis contains one empty I/O slot in addition to the two serial ports and one parallel port. If you use the on-board ARCnet adapter, this slot is free because all of the basic video devices and ports are built in. The serial and parallel ports each use a full-size DB-25 instead of the smaller 9-pin connectors made popular by IBM.

The unit comes with 1MB of memory contained in four 256K SIMMs. This configuration supplies 640K of conventional memory and converts the extra RAM into either extended or expanded memory under the LIM 4.0 EMS specification. You can use 1MB SIMMs to expand RAM up to a total of 8MB.

Racore LANstation SL80 Racore Computer Products Inc. $1,779	NCR 3392 NCR Corp. $1,965	ATlantis Corman Technologies Inc. $1,995	Earthstation-IIe Earth Computer Technologies $1,995	3Com 3Station/2E 3Com Corp. $2,495	Dell Network Workstation Dell Computer Corp. $2,499	ALR VIP 20386DL Advanced Logic Research Inc. $2,595
512K	640K	1MB	512K	1MB	640K	1MB
2	4	1	None	None	3	5
1	2	1	None	None	2	2
80	85	53	40	25	100	65
●	●	●	○	○	○	●
●	●	●	○	○	●	●
2.75 x 15.7 x 15.5	6.5 x 16.1 x 8.5	2.5 x 16 x 15.3	2.75 x 18.5 x 7.75	3 x 14 x 14	4 x 16 x 16	5.5 x 8.5 x 16
80286	80286	80286	80286	80286	80286	80386
20 MHz	6/10 MHz	10 MHz	11.9 MHz	10 MHz	20 MHz	20 MHz
User-supplied	User-supplied	User-supplied	Integrated ARCnet or Ethernet	Integrated Ethernet	Integrated Ethernet	User-supplied
User-supplied	Integrated EGA or MCGA	Integrated EGA	Integrated EGA, CGA, or Hercules	Integrated mono, CGA, EGA, and VGA	Integrated EGA or VGA	User-supplied
1 year	1 year	1 year	1 year	1 year	1 year	1 year
Award 3.03	NCR 4.6	Award 3.03B	Award 3.03	Phoenix 3.10	Phoenix 3.10	Phoenix 1.10.02C

The video adapter integrated into the ATlantis motherboard gives EGA or CGA capabilities at the flip of a switch. This switch is on the back panel to make it easy to change monitors.

Other standard features of the ATlantis include an Enhanced-style 101-key keyboard and network status lights located on the front bezel. These status lights tell you when the network adapter is active and transferring data. This can be reassuring to those who miss the disk noises or other indications that tell them something is happening.

The unit is IBM PC AT compatible and uses an Award ROM BIOS, Version 3.03B. The best feature of ATlantis is its easy setup and integration with the net-

Corman Technologies' small-footprint diskless workstation is called the ATlantis. The 10-MHz 286-based machine comes fully loaded with a coprocessor, video and I/O ports, and enhanced expansion capabilities.

Benchmark Tests: Diskless LANstations

Because these LANstations are both network devices and desktop PCs, we used both our Network Throughput Under Load test and our standard hardware benchmark test suite. Where possible, we used the same Gateway 8-bit Ethernet card in each workstation. The server for this test was an IBM PS/2 Model 80 running Novell's *NetWare*, Version 2.12, and equipped with a 3Com EtherLink Micro Channel adapter. No other load was placed on the network or server during the tests. The hardware performance tests were run on the LANstations to show how they work as standalone PCs.

Aside from CPU speed itself, the biggest performance boosters are page-mode RAM and interleaved memory. Page-mode RAM reduces the number of wait states sent to the processor by the memory. The first access to a page of memory uses one wait state, but subsequent accesses to the same page are made without a wait state. This leads to the .7-wait-state average quoted by some manufacturers.

Interleaved memory is a technique that tries to overcome the delays normally needed to refresh dynamic memory. In this process, one bank of memory is refreshed while another bank is accessed.

The Racore LANstation SL80 and the Dell Network Workstation owe their fast performance both to high CPU speed and to these memory management techniques. Since the 80386-based workstations we tested are not using software specifically designed for the capabilities of the 80386, they are operating in a mode emulating fast 8086s. Their tested times reflect this limitation, but the ALR VIP 20386DL still emerges as one of the fastest machines.

The **NOP** benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instructions in a big 128K loop
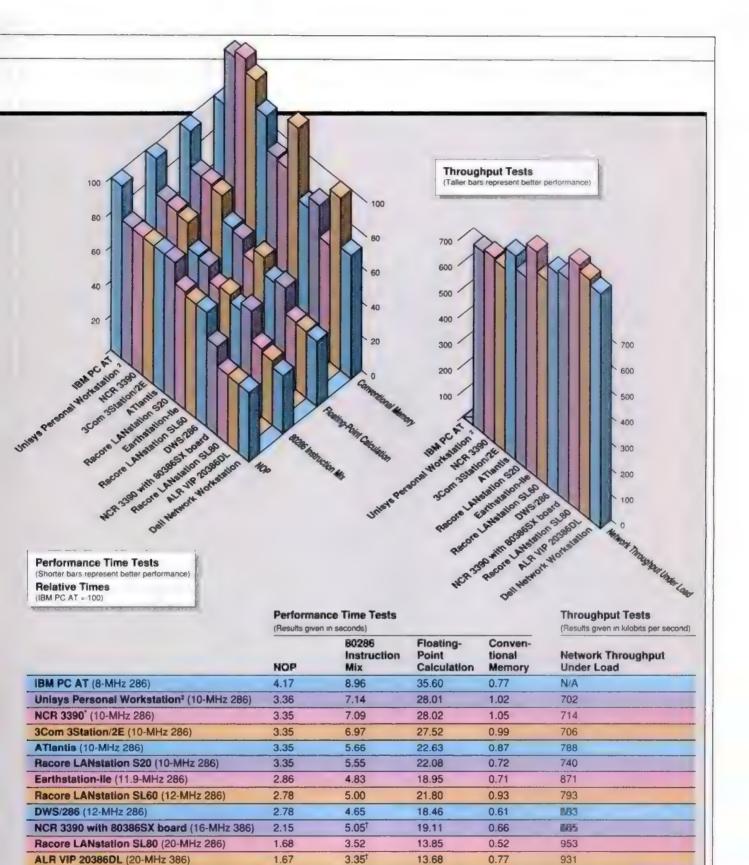
The **80286 Instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 80286 instruction code These instructions are a subset of the total processor instruction set

The **80386 Instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 80386 instruction code These instructions are a subset of the total processor instruction set. The 80386 Instruction Mix implements a number of 32-bit operations. In the 80386 processor these become single instructions, whereas in the 8086 and 80286 versions of the benchmark test they remain multiple instructions.

The **Floating-Point Calculation** benchmark test measures processor speed by looping through a series of floating-point calculations, including multiplication, division, exponentiation, and logarithmic and trigonometric functions. The benchmark program uses the floating-point library included with Microsoft C Compiler 4.0.

The **Conventional Memory** benchmark test allocates 256K of conventional memory and treats it as a series of 64-byte records. Then, 16,384 random records are read into and written from this memory. The result shown is the average of the read and write times.

The **Network Throughput Under Load** benchmark test reports the throughput recorded during the performance of a standardized task on the network To obtain the figures shown here, we run a test program performing a sequential create, a sequential read, a sequential write, a random read, and a random write of a large file. The record sizes used in these activities systematically rotate among 16K, 4K, and 512 bytes. The results shown represent the average throughput over a period of time sufficiently long to ensure consistency. Usually a 1MB file is used, but this size may be adjusted for unusually fast or slow networks

While the timed test is run, we load the network with other special programs. The Network Throughput Under Load test sequence puts a heavy load on the network interface (cards, media, and access protocols) while placing a minimal load on the hard disk and file server software. In this test, each load station continuously reads and writes its own 1-byte data file, changing the data each time. This creates a high volume of data packets and strong contention at the network interface level.

Throughput Tests
(Taller bars represent better performance)

Performance Time Tests
(Shorter bars represent better performance)
Relative Times
(IBM PC AT = 100)

	Performance Time Tests (Results given in seconds)				Throughput Tests (Results given in kilobits per second)
	NOP	80286 Instruction Mix	Floating-Point Calculation	Conventional Memory	Network Throughput Under Load
IBM PC AT (8-MHz 286)	4.17	8.96	35.60	0.77	N/A
Unisys Personal Workstation² (10-MHz 286)	3.36	7.14	28.01	1.02	702
NCR 3390* (10-MHz 286)	3.35	7.09	28.02	1.05	714
3Com 3Station/2E (10-MHz 286)	3.35	6.97	27.52	0.99	706
ATlantis (10-MHz 286)	3.35	5.66	22.63	0.87	788
Racore LANstation S20 (10-MHz 286)	3.35	5.55	22.08	0.72	740
Earthstation-IIe (11.9-MHz 286)	2.86	4.83	18.95	0.71	871
Racore LANstation SL60 (12-MHz 286)	2.78	5.00	21.80	0.93	793
DWS/286 (12-MHz 286)	2.78	4.65	18.46	0.61	853
NCR 3390 with 80386SX board (16-MHz 386)	2.15	5.05[†]	19.11	0.66	885
Racore LANstation SL80 (20-MHz 286)	1.68	3.52	13.85	0.52	953
ALR VIP 20386DL (20-MHz 386)	1.67	3.35[†]	13.68	0.77	931
Dell Network Workstation (20-MHz 286)	1.67	3.02	13.40	0.55	910

N/A—Not applicable throughput tests were not run on the PC AT.
*Test results for the NCR 3392 were the same as for the 3390
[†] 80386 Instruction Mix test results

work. If you use ARCnet, there are no cards, jumpers, or internal switches to set. In fact, there is no reason to open the unit. Setup is totally menu driven using Ctrl-Alt-Esc to run the menu that sets the CMOS.

The power supply in the ATlantis station uses a small fan that makes very little noise. It complies with UL, Canadian Standards Association, VDE (West German), and FCC Class B certifications.

This diskless workstation is recommended for executives who demand that little or no space be taken from their desks. And for those tying in to an ARCnet environment, the ease of setup can't be beat. —David Byrd.

DELL COMPUTER CORP.
Dell Network Workstation

As a full PC with disk drives, the Dell System 220 has received favorable reviews in *PC Magazine*. Its fraternal twin, the Dell Network Workstation, offers the same speedy 20-MHz operation while coming fully equipped to log on to an Ethernet network.

The Dell Network Workstation combines flexibility with built-in features. The system comes with two serial ports, a parallel port, a hard-and-floppy-disk controller, and even a VGA video interface on the motherboard. The motherboard can hold
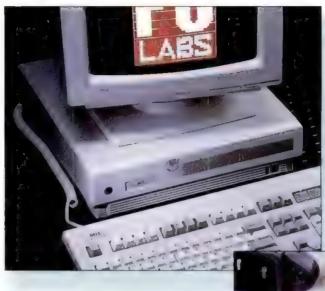
The keyboard connector of the $2,499 Dell Network Workstation is unique, even among Dell products. If you ever want to replace the keyboard, you'll either have to go to Dell or splice in a new connector.

up to 8MB of RAM using 1MB SIMMs. A 3Com EtherLink-II network adapter equipped with a remote-boot ROM is shipped in one expansion slot, leaving two 16-bit slots free for an internal modem, a fax card, or other devices.

This flexibility means that if you want to gain some freedom from total dependence on the network while keeping the security of a LANstation, you can add only a hard disk drive. The power cables are already in place and the 100-watt power supply can carry the load. The trade-off for the flexibility is a fan in the power supply. Unfortunately, it is not a very quiet fan, and to our minds, quiet operation is one of the blessings of a LANstation.

The Network Workstation package includes a monitor, and the system's price depends on which one you choose. Prices range from $2,499 for a system with a monochrome monitor to $2,799 for a system with a VGA Color Plus display.

Standing 4 inches high, the Network Workstation is a little taller than many of its competitors, but its 16- by 16-inch footprint doesn't give away much space to its skinnier cousins.

We have only two complaints about the Dell system. First, the fit between the cards and the back panel causes the rear connectors of some 16-bit cards to rise out of their sockets when the screw on the back panel is tightened. Second, the design of the keyboard connector is unique, even among Dell products. If you ever want to

replace the keyboard, you'll have to either buy one from Dell or splice in a new connector.

FAST PERFORMANCE The Network Workstation is fast. The 80286 processor runs at 20 MHz, but it doesn't slow down for memory operations because Dell gives the 220 the same page mode and interleaved memory used in its more-expensive 386 systems. The Dell didn't quite outperform its fastest competition, but it did very well.

One factor that can't be left out of a LANstation buying decision is support. Dell has leasing arrangements, customer-service telephone lines, and on-site service contracts. The company will sell you pieces and parts to allow you to upgrade the system and other accessories such as printers and software.

The Dell Network Workstation appeals to anyone who wants a fast workstation with two expansion slots or who isn't quite sure whether he or she wants to abandon

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The **SL** has four parallel and six serial channels, with all ten being user configurable as either an input or an output, so you can share any combination of PCs and peripherals. If you need more than ten channels, you can link several **SLs** together. All channels can be in use at the same time to rapidly transfer data and quickly release your PCs to continue working instead of being delayed for printing. The **SL** software even allows your PC to send data at 19,200 baud. All memory (user upgradeable up to 4MB) is dynamically allocated and efficiently shared by all channels as needed. The **SL** comes with menu-driven software to install the pop-up menu for easy selection of printers and control options, but you don't have to be a programmer to use it. Of course, the **SL** works just fine without our software too! The **SL** has many other features so ask us to send you more information.

When you compare the price and capabilities of the Buffalo SL with any similar devices, we believe you will agree with thousands of well-informed professionals that the SL is the best value available anywhere!

Buffalo Products also makes PC memory expansion systems boards, other smaller buffers, automatic switches, and interface conversion devices. All of our products come with a **45 DAY MONEY BACK GUARANTEE.** Call us **TOLL FREE** and talk to one of our friendly application technicians for solutions to your connectivity problems.

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CIRCLE 328 ON READER SERVICE CARD

standalone operation forever. Its performance, features, and support make it a good choice.—**Frank J. Derfler, Jr.**

EARTH COMPUTER TECHNOLOGIES
Earthstation-IIe

Earth Computer Technologies' Earthstation-IIe is a truly secure diskless workstation. It's an 80286-based, Novell-compatible machine self-contained within its 101-key keyboard: it has no CPU box. The Earthstation runs at 12 MHz with zero wait states. Expandable to 4MB RAM, it performs the most complex, demanding DOS applications. Standard RAM is 512K, but memory can be expanded to 1, 2, or 4MB by swapping memory chips. The keyboard housing contains the memory, processor, video adapter, and network interface, yet it is only ¼ inch taller than an IBM Enhanced–style keyboard—and the weight is actually slightly less.

An IEEE 802.3 Ethernet standard interface and video adapter (VGA, EGA, CGA, or Hercules) are part of the single motherboard design. Printers, mice, modems, cash drawers, bar code readers, and so on can all attach via parallel and serial ports at the rear of the keyboard. CMOS technology means low power consumption and heat levels; no fan is necessary.

Included with the keyboard is a satellite interface box connected by a 4½-foot cable. The interface box allows the Ethernet wires and connectors, video cable, and power supply to be separated from the actual keyboard. There is only one cable to the keyboard. A 25-watt power supply

F A C T   F I L E

Earthstation-IIe
Earth Computer Technologies
10525 Lawson River Ave.
Fountain Valley, CA 92728
(714) 964-5784
List Price: $1,995, including satellite interface box.
Requires: Monitor.
In Short: The Earthstation is a 286-based Ethernet diskless workstation contained entirely within a 101-key keyboard. Expansion cards are installed in a separate interface box. Fast, simple, space-saving, and secure, it's an up-and-comer in the diskless workstation arena.
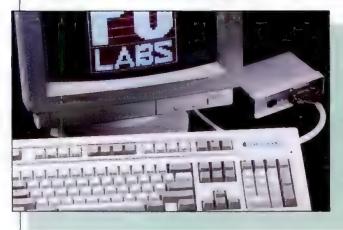
CIRCLE 389 ON READER SERVICE CARD

box, about the same size as those used for laptops, connects between the satellite interface box and the AC wall socket.

Installation is simple. A hotkey sequence calls up a menu-driven setup utility that configures the video mode, diskless boot type, and serial modes. There are no switches or jumpers. Two diagnostic LEDs on the satellite box indicate proper connection to the network. The Earthstation includes diskless boot capability for Novell 2.0a, 2.1x, and ELS, as well as NetBIOS for all NetBIOS-compatible networks (3Com and IBM, for example). There is also an open socket for a "user's choice" boot ROM.

ECT maintains unlimited technical support via phone and is considering a support BBS. Sales are direct from ECT.

The Earthstation-IIe is a clever, com-

Earth Computer Technologies' Earthstation-IIe saves desk space with an innovative design. The unit has no CPU box. All the necessary chips are contained within its 101-key keyboard. An outboard interface box completes the package.

pact LANstation design requiring minimum desk space while affording maximum 286 computing power. It is a truly diskless workstation because there are no expansion slots—period. Hence it would be extremely difficult to steal data or programs from the server. Bantam size, low heat, complete silence, and foolproof security are the Earthstation's advantages. They are a winning combination.
—Mike Byrd

NCR CORP.
NCR 3390
NCR 3392

In the late 1800s, NCR started selling cash registers under the company name of National Manufacturing Company. Today, NCR still sells cash registers, but their computer products make news as well. Two of their latest are the compact 3390 and the flexible 3392 LANstations.

The 3390 is a small desktop unit with

limited expansion capability, while the 3392 can expand in steps up to the capabilities and size of a full AT. Aside from all of the other features of the 3390, a major selling point is its $1,043 price tag. When you consider that the price includes an EGA video adapter, a fast processor, 640K RAM, and NCR support, it's a bargain. All you have to add is a LAN card and a monitor.

The 3390 is 15⅓ inches long, 11 inches wide, and 2¾ inches tall—a bit smaller than a pizza box—and weighs only 8.2 pounds. The 3392 is more like a sandwich. The base slice is the same size as the 3390's, but it is 4 inches high. You add 2-inch-high expansion boxes to increase its capacity.

The small size of these units doesn't stop you from adding either an internal 3½-inch floppy disk drive or a 20MB hard disk. An external drive interface is also available. The disk controller comes standard with the basic workstations. Even with the added feature of a floppy or hard disk, this unit is as quiet as a mouse. NCR will configure a workstation to the needs of one individual or multiple machines for an entire organization.

The 3390 and 3392 workstations are based on the same plug-in processor board that comes in both 80286 and 80386 versions. The 80286 boards have variable processor speeds of 6 MHz and 10 MHz

with a coprocessor option (80287-8). The 80286 machine is easily upgraded to the 16-MHz 80386 technology by unplugging the 80286 processor board and plugging in the 80386-16 board. If you want to upgrade to the 80386, NCR has a trade-in plan for the old board.

The video display integrated into these units supplies EGA, CGA, and mono ca-

The network connector at the rear of the $1,043 NCR 3390 (right) is in a 4- by 2-inch recess. The depth of that recess makes it difficult to install standard Ethernet T-connectors, though ARCnet and Token-Ring connections don't present a problem. The $2,174 NCR 3392 (left) features expandability through add-on modules.

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pabilities. You can choose from three keyboards: the Standard (10 function keys), workstation (12 function keys), and Advanced PC AT (30 function keys). Both the 3390 and 3392 have 25-pin parallel and serial ports built into the basic workstation.

Both the 3390 and 3392 have 640K of RAM in their standard configuration. The 3390 can be upgraded to 2.6MB, and the 3392 can be upgraded to 16MB of extend-

---

■ **NCR offers expansion modules with drive options. The 3392 has an interface to an integrated 40MB multimode tape drive for network backup.**

---

ed memory using the NCR memory board.

We have one minor gripe about the 3390. At the rear of the unit the network connector is in a 4- by 2-inch recess. The depth of the recess makes it difficult to install standard Ethernet T-connectors. ARCnet and Token-Ring connections shouldn't be a problem, but you need to get a long-neck T-connector for your Ethernet adapter attachment.

A unique feature of the 3392 is the add-on capability of the unit. The expansion units stack one on top of another. By adding another expansion module to the top of an existing workstation, you gain two more expansion slots. The expansion cabinets connect with a 2- by 4-inch metal tab that actually extends the bus from one module to another. This avoids the need for an ugly connecting cable. Adding a module increases the workstation height by approximately 2½ inches.

NCR can configure expansion modules with drive options. The 3392 has an interface to an integrated 40MB multimode tape drive for network backup.

The simple setup and installation of the NCR workstations are made easy by the documentation and the internal menu system of these LANstations. Any hardware

configuration error displays a message prompting you to run the hardware setup menu. The setup menu lets you enter parameters to update the CMOS chip controlling the hardware configurations. Our telephone calls to the NCR technical support staff proved them to be professional and very responsive. If your LANstation needs vary across your network and require individually customized machines, NCR offers one of the best one-stop solutions.—**Randol Tigrett**

NETWORK INNOVATIONS CORP.
DWS/286

Network Innovations Corp. specializes in manufacturing ARCnet cards. The DWS/286 is its first entry into the LANstation market. A user-customizable system, its basic component is a 6/12-MHz, 0/1-wait-state, 80286 motherboard mounted in a small case. You supply the video, I/O, and network cards.

Network Innovations' products are available and supported through resellers. The 512K DWS/286 LANstation sells for $1,095; a 1MB model is available for $1,345. Both come with documentation that gives enough information to let you set them up in many different LAN environments.

The DWS/286 has a variety of options, allowing the user to customize it for various needs. Most of the system options can be set via jumpers and DIP switches on the

motherboard, and the speed can be changed from the keyboard. The system's memory circuitry includes support for both LIM EMS 4.0 and 1MB DRAMs, thereby allowing 4MB of memory on the motherboard.

The small cabinet of the DWS/286 measures 3½ by 15 by 15¼ inches and weighs 16 lbs. The station has four full-length expansion slots, two 8-bit and two 16-bit, oriented horizontally. This arrangement is made possible by using two right-angle slot adapters, but it also makes for a tight fit for certain boards with large edge connectors or tall components.

Network Innovations opts not to in-

Network Innovations Corp.'s DWS 286 is a customizable LANstation built with low-power components for quiet operation. The basic unit, with 512K or 1MB RAM, is equipped with an empty 6/12-MHz 286 motherboard. You supply the video, I/O, and network cards.

clude a monitor card or serial and parallel ports. The power supply outputs 50 watts but is missing the extra 12 volts needed to run a serial port or a modem. Network In-

■ **The DWS/286's power supply outputs 50 watts but lacks the extra volts you need to run a serial port or modem.**

novations offers a fix to this problem with a little card at additional cost. The DWS/286 uses the Award ROM BIOS, Version 3.03.

To the company's credit, the DWS/286 is built with CMOS (low power) components, allowing a fanless power supply for silent operation. The size of the unit is also nice, since the footprint is small and the box isn't very tall. The user has complete flexibility in adding the components necessary to meet his or her needs.

Overall, however, the DWS/286 does not measure up to its peers. The product is relatively expensive when completely configured. With 12-MHz 80286-based PCs selling for $1,700, it hurts to pay more for just a small footprint and quiet operation.
—**M. Keith Thompson**

RACORE COMPUTER PRODUCTS INC.
LANstation S20
LANstation SL60
LANstation SL80

"The Racore LAN product line is now the most complete in the industry," announces the company's product brochure. Racore also touts the fact that it is a Novell OEM, which gives it an inside track to developing *NetWare*-compatible products. We looked at three different Racore LANstations—the SL80, SL60, and S20—all using Gateway Communications G/Ethernet interface cards. The three Racore

The Racore LANstation SL80's 20-MHz 286 chip makes it the most powerful Racore model. The motherboard has three standard AT-type slots, but only two are available because a right-angle connector is used to make the cards fit into the box.

LANstations share the same 2¾- by 15⅔- by 15½-inch (HWD) cabinets but have different motherboards.

The SL80 is Racore's top-of-the-line workstation. This model houses an 80286 processor running at 20 MHz. All SL models come standard with 512K RAM, two serial ports, one parallel port, and Version 3.03 of the Award BIOS. Two slots are available for the video and network adapter cards you supply. The SL80 is the $1,779 high-power model that would be greatly appreciated by power spreadsheet and CAD users.

The memory is expandable to 4MB and has an integrated LIM/EMS controller (Chips and Technologies NEAT chip set) supporting the EMS 4.0 standard. The model we tested was configured with 4MB of .7-wait-state memory, a Paradise VGA card, and an Enhanced-style keyboard. The keyboard has a nice feel to it, with a moderate click.

You have to insert your own network interface card into the SL80 to link it to the LAN. The motherboard has three standard AT-type slots, but only two are physically available because of the configuration of the cabinet. A right-angle connector is used to make the cards fit into the low box. We encountered a clearance problem with the Gateway Ethernet card. Gateway uses a ceramic insulator on the base of the coaxial connector that wouldn't properly fit through the narrow opening in the right ex-

pansion slot. After swapping cards around, we managed to get it into the left slot.

People who don't need the snappy power of the SL80 can save $400 and buy the $1,379 Racore model SL60, a 12-MHz 80286 machine with the same configuration of serial and parallel ports as the SL80. The major difference is the slightly slower processor and the lack of EMS hardware support.

Installing the Ethernet card in the SL60 was very simple compared with the ordeal of the model SL80. The system we tested was configured with 1MB RAM and a monographics video card. Racore uses 256K DRAM chips in the systems that it ships with up to 1MB of memory, and 1MB DRAM chips to increase the size to 4MB. A serial mouse could be added using one of the two available serial ports. This model performed similarly to the SL80. The SL80's extra horsepower comes into play when you're number-crunching spreadsheets, but it would not be needed

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PC MAGAZINE EDITOR'S CHOICE

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FACT FILE

Racore LANstation S20
List Price: With 512K RAM, 10-MHz 80286, and two 8-bit slots, $979.
Requires: Network interface and video adapter cards.
CIRCLE 403 ON READER SERVICE CARD

Racore LANstation SL60
List Price: With 512K RAM, 12-MHz 80286, and two 8/16-bit slots, $1,379.
Requires: Network interface and video adapter cards.
CIRCLE 404 ON READER SERVICE CARD

Racore LANstation SL80
List Price: With 512K RAM, 20-MHz 80286, and two 8/16-bit slots, $1,779.
Requires: Network interface and video adapter cards.
In Short: These three diskless LANstations provide an alternative for the LAN administrator looking for cost-effective workstations to add users to the system. Each model presents a price/performance tradeoff that must be evaluated against the type of work for which the unit will be used.
CIRCLE 405 ON READER SERVICE CARD

by most people who are using word processing and similar applications.

The Racore model S20 is a lower-cost machine running an 80286 processor at 10 MHz. The version we tested was equipped with a monographics card and 512K RAM. You can put up to 2MB RAM in the S20, and the system uses a Quadtel Version 1.03 BIOS.

This unit had the same problem accommodating the Ethernet card that the SL80 had. The monographics card had to be placed in the left-hand slot, while the Ethernet card was placed in the right-hand slot. The S20 system's strong suit consists of giving you AT capability for a $979 price tag. Racore also offers an 8-MHz 8088 system with a $599 retail price.

All of the models tested were very quiet and showed no noticeable heat problems. An 80-watt power supply is standard in all three. Racore offers a 1-year limited warranty with repair services available at the factory or through authorized dealers.

Straightforward and uncomplicated, these three Racore LANstations are certainly worth a look.—**Paul Ferrill**

3COM CORP.
3Com 3Station/2E

3Com has been in the PC networking business as long as the business has been around. One would expect 3Com to know what a user is looking for in a LANstation, and the 3Station/2E is what the company's years of experience have produced. At $2,495 the station is a little on the expensive side, but it's a winner nevertheless. The model is available and serviced from the many 3Com dealers and resellers throughout the country.

The 3Station/2E is an Ethernet-only device, but it is not a 3Com-only LANstation. We booted it from a Novell server using special software for the 3Station supplied by Novell through its NetWire service on CompuServe.

The station measures 3 by 14 by 14 inches (HWD), giving it a small and space-saving footprint. The unit is based on a 10-MHz 80286 processor with provision for an 80287 math coprocessor. Silent operation comes from a fanless 25-watt power supply. 3Com chose the Phoenix Version 3.10 BIOS and a Fujitsu key-

FACT FILE

List Price: $2,495 including 1MB RAM, Ethernet interface card, VGA adapter card.
Requires: Monitor; *3+Share* or *3+Open*; Novell's *NetWare* 2.1 LAN server.
In Short: An all-in-one unit, requiring only the addition of a monitor. Users will get fast, dependable service out of the 3Station/2E. 3Com's reputation for quality products and customer satisfaction makes it a reliable choice.
CIRCLE 406 ON READER SERVICE CARD

board.

The 3Station/2E is a custom LANstation built from scratch, not just a motherboard stuffed into a small case. It doesn't have any expansion slots, but it doesn't need them. This station has all the works built onto the single board of the computer.

The 3Station/2E comes standard with 1MB of memory, two serial ports, and one parallel port. There is room for an additional 4MB using 1MB SIMMs. The user can attach any monitor from monochrome

3Com's 3Station/2E is a custom-built Ethernet-only, space-saving LANstation based on a 10-MHz 80286 processor. Because all options are built onto the system board, no expansion slots are necessary. The machine's list price is $2,495.

text-only to multicolor/frequency, thanks to the 16-bit enhanced VGA adapter built in. As you would expect from the company that is the home of Ethernet, the 3Station/2E has an Ethernet card included as well.

Knowing that networks use a lot of memory, 3Com has found a clever way to let users have an extra 128K of standard RAM. Since the 3Station/2E doesn't have expansion slots, 3Com does not have to reserve all the memory from 640K to 1MB for third-party add-in devices. The company supplies a driver that lets standard DOS applications make use of 128K of high memory in the system.

Overall, the 3Station/2E is a complete product that performs as expected. The only thing we could find to pick on is that the LIM 3.2 expanded RAM is emulated in software, thus not allowing LIM 4.0 memory. But the small footprint and elegant design make it a very attractive unit.
—M. Keith Thompson

UNISYS
Unisys Personal Workstation² Series 300

Unisys, the mainframe manufacturer, is now in the PC workstation business. Their Personal Workstation² Series 300 is a small 80286 PC suitable for use as a diskless workstation or a standalone PC.

The Series 300's processor is an 8/10-MHz 80286 with 640K RAM. Options include a memory expansion kit that allows

an additional 1MB of memory to be added on the system board (it does not support LIM 4.0) and an 80287 math coprocessor. The system unit contains three full-length expansion slots.

■ **3Com has found a clever way to let 3Station/2E users have an extra 128K of RAM.**

The diskless workstation version of the Series 300 contains an enhanced graphics controller that supports monochrome, CGA, and EGA monitors, and a network adapter card as well. The third slot is available.

The power switch is on the front panel of the 4- by 15- by 16-inch system (why can't they all be like this?), and a system reset button is located right below the power switch. Connectors for the power, keyboard, monitor, parallel port, and serial port are on the back of the system unit.

The Series 300 is accompanied by excellent documentation. The installation guide is one of the best-written and easiest

The Unisys Personal Workstation² Series 300 can work equally well as a diskless workstation or a standalone PC. It includes an enhanced graphics controller and a network adapter card. One expansion slot remains free.

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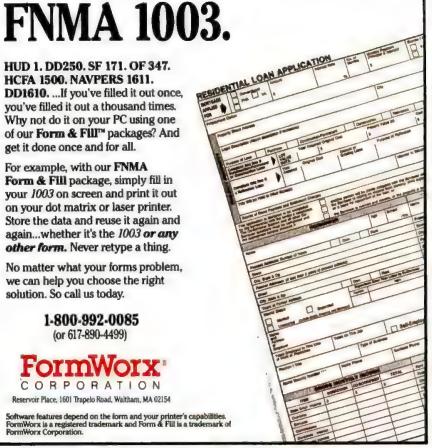
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■ DISKLESS LANSTATIONS

to follow that we've seen. It contains many pictures and schematics illustrating item locations, DIP switch settings, and jumper positions. Software setup of the station itself is equally easy, with menu-driven installation routines and diagnostic utilities.

The Series 300 contains room for an internal 1.2MB half-height floppy disk drive and a half-height hard disk as well. The 114-watt power supply should be quite adequate for additional drives.

Unisys offers toll-free service for installation support. Technical support is avail-

> ■ The Unisys Series 300 has the flexibility to be configured as either a diskless LANstation or one with storage devices.

able through Unisys service contracts.

The Series 300 is a solid, dependable 286 machine. The flexibility to be configured either as a diskless LANstation or one with storage devices is its main asset. Documentation is superior both in installation and diagnostic support. Priced at $1,305, it is a strong competitor in the LANstation market.—**Mike Byrd** PC

David Byrd is an applications programmer for the state of Florida and is completing a master's degree at the University of West Florida. Mike Byrd holds master's degrees in engineering and computer science. A fighter pilot for the U.S. Air Force, he is also a division chief in a branch of the federal government that develops sophisticated electronics systems. Frank J. Derfler, Jr., is workgroup systems editor for PC Magazine. Paul Ferrill is an electrical engineer whose articles have been published in the Proceedings of the IEEE. He has a wide range of experience in micro- and minicomputer systems. M. Keith Thompson is the inventor of the AT TurboSwitch and the founder and CEO of Megahertz Corp. Randol Tigrett is a project leader at PC LAN Labs.

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■ UTILITIES ■ MICHAEL J. MEFFORD

FINE-TUNING YOUR MOUSE MOTION

Microsoft and IBM mouse drivers provide only two-speed mouse action. MOUSECTL lets you tailor mouse motion for better drawing control and more-rapid page scanning.

If you use your mouse regularly, you've probably found that its response is too fast when you have a delicate drawing job and not fast enough when you want to zip across the screen. You can set the mouse sensitivity adjustment for slow, precise control, of course, but if you then need to dart over to a menu selection box you have to make multiple strokes, like revving up a child's friction toy. And you can choose a threshold above which the mouse speed doubles, but this, too, is an all-or-nothing setting that results in a sudden jump in response when the threshold is crossed.

The frustrating crudity of the available adjustments and indications that I was beginning to develop mouse wrist (akin to tennis elbow) led me to design MOUSECTL. What you need is simply a way to set *multiple* sensitivity levels for controlling the mouse actions. For slow movements, the cursor should be damped, but as the mouse accelerates, the cursor should smoothly multiply its rate of movement. Further, the whole multiple-sensitivity scheme should also be user-changeable, so you can set different parameters for different programs. And finally, you should be able to run the whole affair through your AUTOEXEC.BAT file or from a series of batch files so you don't have to remember all your optimized settings.

MOUSECTL.COM does all of this, but within two restrictions that may or may not affect you. First, MOUSECTL works only with the Microsoft or the IBM mouse drivers. That's because other popular mouse drivers, such as Logitech's and

Mouse Systems', reflect what turns out to be some inaccurate documentation in the *Microsoft Mouse Programmer's Reference Guide*. I'll go into the details of this story and an explanation of how MOUSECTL works later in this article.

The second limitation of MOUSECTL is that it will not control the mouse cursor

of such *Microsoft Windows* utilities as the MS-DOS Executive and the Notepad. This restriction also rules out programs such as *PageMaker* and *Excel*, which *require* the *Windows* operating environment. Within *Windows*, however, MOUSECTL will work with applications that do not directly require *Windows* for their operation.

The reason for this is that *Windows* insists on loading its own mouse driver, and this disables MOUSECTL. Even if you load the driver that came with your mouse before you load *Windows, Windows* will use its own mouse driver for all *Windows*-specific applications. If you use your mouse only for *Windows* applications, therefore, loading the mouse driver supplied with your mouse is simply a waste of memory.

If you can make use of MOUSECTL, however, the easiest way to get a copy is by downloading it from PC MagNet, as explained in the accompanying sidebar, "MOUSECTL by Modem." As an alternative, its source code, MOUSECTL .ASM, is printed here, as is MOUSE-CTL.BAS, a BASIC program that will automatically create MOUSECTL.COM when you run it once in BASIC. Both MOUSECTL.ASM and MOUSECTL .BAS can also be downloaded from PC MagNet.

The full MOUSECTL syntax is

`MOUSECTL [n ... n | filename | /U]`

where *n* specifies up to eight mouse *multipliers,* whose values range from 0 to 32767. I'll explain the multiplier options below; in most situations the default *n* val-

■ UTILITIES

ues (5,6,10,15,22,30,50,70) will suffice. MOUSECTL must be loaded *after* you have loaded your regular mouse driver (MOUSE.COM or MOUSE.SYS). Once loaded, MOUSECTL can be removed from memory by entering the command along with the /U (uninstall) switch. As with all TSRs, however, MOUSECTL must be removed in the same order in which it was installed if the 1KB of memory it takes up is to be successfully reclaimed.

MOUSECTL is smart enough to install itself only once, even if invoked multiple times in the same session. Its installation can be simplified by creating a batch file that automates the process. A typical configuration would be

```
MOUSE
MOUSECTL
application
MOUSECTL /U
MOUSE OFF
```

If you use the device driver version of the

mouse driver by adding the statement DEVICE=MOUSE.SYS to your CONFIG.SYS file, then you would remove the two MOUSE(.COM) references from the batch file above. The simplest method is to add MOUSECTL to your AUTOEXEC .BAT file.

CHOOSING MULTIPLIERS A brief explanation of mouse mechanics will help you understand the multiplier option. When you move the mouse, a ball on its

```
;------------------------------------------------;
; MOUSE.CTL - Enhances mouse sensitivity control.;
; PC Magazine - Michael J. Mefford                ;
;------------------------------------------------;
_TEXT           SEGMENT PUBLIC 'CODE'
                ASSUME CS:_TEXT,DS:_TEXT,ES:_TEXT,SS:_TEXT
                ORG     100H
START:          JMP     INITIALIZE

;               DATA AREA
;               ---------
SIGNATURE       DB      CR,SPACE,SPACE,SPACE,CA,LF
COPYRIGHT       DB      "MOUSECTL 1.0 (C) 1988 Ziff Communications Co.",CR,LF
PROGRAMMER      DB      "PC Magazine ",BOX," Michael J. Mefford",CR,LF,LF,"$"
                DB      CTRL_Z

CR              EQU     13
LF              EQU     10
CTRL_Z          EQU     26
SPACE           EQU     32
BELL            EQU     7
BOX             EQU     254
IRET_CODE       EQU     0CFH

OLD_INT_33      DW      ?,?
OLD_INT_10      DW      ?,?

VIDEO_MODE      DB      ?                   ;BIOS data.
DISPLAY_MODE    EQU     49H                 ;Text video mode flag.
TEXT_MODE       EQU     7                   ;Graphics video mode flag.
GRAPHICS        EQU     1                   ;Adjustment for text cell size.
CHAR_WIDTH      DW      ?                   ;Adjustment for graphics cell.
GRAPHICS_WIDTH  DW      ?

MOUSE_VARIABLES LABEL BYTE
HORZ_LAST       DW      0                   ;Mouse driver mickey count total.
VERT_LAST       DW      0
HORZ_ADJUSTED   DW      0                   ;Mickey total application sees.
VERT_ADJUSTED   DW      0
HORZ_REMAINDER  DW      0                   ;Mickey adjustment remainder.
VERT_REMAINDER  DW      0
HORZ_RATIO_REMAIN DW    0                   ;Mickey per pixel remainder.
VERT_RATIO_REMAIN DW    0
HORZ_CURS_REMAIN DW     0                   ;Text cursor mickey remainder.
VERT_CURS_REMAIN DW     0
CALL_MASK       DW      0                   ;Subroutine call mask.
INTERRUPT_SUB   DW      0,0                 ;Subroutine address.
VARIABLES_LENGTH EQU    (0 - MOUSE_VARIABLES) / 2

HORZ_RATIO      DW      0                   ;Mickeys / 0 pixel ratio.
VERT_RATIO      DW      16

RANGE           DW      3, 5, 7, 9, 12, 23, 32; and above
MULTIPLIER      DW      5, 6, 10, 15, 22, 30, 50, 70
MULTIPLIER_END  EQU     0 - 2
MULTIPLIER_LENGTH EQU   (0 - MULTIPLIER) / 2

;               CODE AREA
;*************** INTERRUPT HANDLERS ***************;

NEW_INT_33      PROC    FAR
                OR      AX,AX               ;Is it Reset and Status?
                JNZ     READ_MOUSE
                CALL    MOUSE_DRIVER        ;If yes, call the driver.
                PUSH    AX                  ;Save output.
                PUSH    BX
                PUSH    CX
                PUSH    DX

                CALL    RESET               ;Zero out our variables.
                MOV     CS:HORZ_RATIO,0     ;Restore mickey/pixel ratio.
                MOV     CS:VERT_RATIO,16
                MOV     CX,32767            ;Disable mouse driver cursor
                MOV     DX,CX               ; control by setting mickey
                MOV     AX,15               ; to Pixel ratio very large.
                CALL    MOUSE_DRIVER
                MOV     DX,10000            ;Disable Double-speed by setting
                MOV     AX,19               ; threshold very large.
                CALL    MOUSE_DRIVER
                MOV     CX,1                ;Install our interrupt subroutine
                CALL    SET_INTERRUPT

                POP     DX                  ;Restore returned values.
                POP     CX
                POP     BX
                POP     AX
                IRET                        ;Return to caller.


READ_MOUSE:     CMP     AX,11               ;Is it Read Mouse
                JNZ     SUBROUTINE          ; Motion Counters?
                CALL    MOUSE_DRIVER        ;If yes, call driver.
                CLI                         ;No interrupts, especially mouse.
                MOV     CX,CS:HORZ_ADJUSTED ;Return adjusted mickey count.
                MOV     DX,CS:VERT_ADJUSTED
                MOV     CS:HORZ_LAST,0      ;Reset driver mickey count.
                MOV     CS:VERT_LAST,0
                MOV     CS:HORZ_ADJUSTED,0  ;Reset adjusted mickey count.
                MOV     CS:VERT_ADJUSTED,0
                IRET

SUBROUTINE:     CMP     AX,12               ;Is it Set Interrupt Subroutine
                JNZ     SET_RATIO           ; Call Mask and Address?
                MOV     CS:CALL_MASK,CX     ;If yes, store call mask.
                MOV     CS:INTERRUPT_SUB[0],DX ;Store address.
                MOV     CS:INTERRUPT_SUB[2],ES
                PUSH    CX                  ;Save call mask.
                OR      CX,1                ;Add cursor position changes
                CALL    SET_INTERRUPT       ; and install subroutine.
                POP     CX                  ;Restore CX.
                IRET

SET_RATIO:      CMP     AX,15               ;Is it Set Mickey/Pixel Ratio?
                JNZ     SWAP_INT
                MOV     CS:HORZ_RATIO,CX    ;If yes, store requested values.
                MOV     CS:VERT_RATIO,DX
                IRET

SWAP_INT:       CMP     AX,20               ;Is it Swap Interrupt
                JNZ     DOUBLE_SPEED        ; Subroutines?
                PUSH    CS:CALL_MASK        ;If yes, save old call mask
                PUSH    CS:INTERRUPT_SUB[0] ; and subroutine address.
                PUSH    CS:INTERRUPT_SUB[2]
                MOV     CS:CALL_MASK,CX     ;Store new call mask and
                MOV     CS:INTERRUPT_SUB[0],DX ; subroutine address.
                MOV     CS:INTERRUPT_SUB[2],ES
                OR      CX,1                ;Set our subroutine with
                CALL    SET_INTERRUPT       ; new call mask.
                POP     ES                  ;Return old call mask and
                POP     DX                  ; subroutine address.
                POP     CX
                IRET

DOUBLE_SPEED:   CMP     AX,19               ;Skip Double-speed Threshold.
                JZ      INT_33_END
                CMP     AX,26               ;Skip Sensitivity.
                JZ      INT_33_END
                JMP     CS:DWORD PTR OLD_INT_33 ;Pass all other calls as is.
INT_33_END:     IRET
NEW_INT_33      ENDP

RESET:          PUSH    DI                  ;Preserve registers.
                PUSH    ES
                PUSH    CS
                POP     ES
                XOR     AX,AX               ;Store zeros in appropriate
                MOV     DI,OFFSET MOUSE_VARIABLES ; mouse variables.
                MOV     CX,VARIABLES_LENGTH
                CLD                         ;Forward direction.
                CLI                         ;No interrupts.
                REP     STOSW
                POP     ES                  ;Restore registers.
                POP     DI
                RET

;------------------------------------------------;
; INPUT: CX = Call Mask                           ;
;------------------------------------------------;
SET_INTERRUPT:  PUSH    AX                  ;Preserve registers.
                PUSH    DX
                PUSH    ES
                PUSH    CS
                POP     ES
                MOV     DX,OFFSET MOUSE_CONTROL ;Install our subroutine.
                MOV     AX,12
                CALL    MOUSE_DRIVER
                POP     ES                  ;Restore registers.
                POP     DX
                POP     AX
                RET

;------------------------------------------------;
MOUSE_DRIVER:   PUSHF
                CLI
                CALL    CS:DWORD PTR OLD_INT_33
                RET                                          (continues)
```

MOUSECTL.ASM: *The source code for MOUSECTL.COM, a small TSR that lets you vary the sensitivity of your IBM or Microsoft mouse.*

```
;----------------------------------------------;
NEW_INT_10  PROC    FAR
            OR      AX,AX                       ;Video mode change?
            JZ      INT_UPDATE                  ;If yes, update variables.
            CMP     AH,11H                      ;Is it User Alpha Load?
            JAE     INT_UPDATE                  ;If yes, update variables.
            JMP     CS:DWORD PTR OLD_INT_10     ;Else, no business.
INT_UPDATE: PUSHF                               ;Update by calling INT 10
            CALL    CS:DWORD PTR OLD_INT_10
            CALL    GET_BIOS_DATA               ;Then retrieve video data.
            IRET
NEW_INT_10  ENDP

;----------------------------------------------;
GET_BIOS_DATA: PUSH AX                          ;Preserve registers.
            PUSH    DS
            MOV     AX,40H                       ;Point to BIOS data.
            MOV     DS,AX
            MOV     AL,DS:DISPLAY_MODE          ;Retrieve display mode.
            PUSH    CS
            POP     DS                          ;Point to our data.
            MOV     AH,TEXT_MODE                ;Assume text mode.
            MOV     CHAR_WIDTH,16               ;Assume low resolution.
            CMP     AL,1                        ;Is it 40 column?
            JBE     BIOS_END                    ;If yes, assumed right.
            MOV     CHAR_WIDTH,8                ;Else, assume high resolution.
            CMP     AL,3                        ;Is it 80 column color or
            JBE     BIOS_END
            CMP     AL,7                        ; MONO?  If yes, assumed right.
            JZ      BIOS_END

            MOV     AH,GRAPHICS                 ;Else, gotta be graphics mode.
            MOV     GRAPHICS_WIDTH,1            ;Assume low resolution.
            CMP     AL,5                        ;Is it mode 4, 5, D, or 13?
            JBE     BIOS_END                    ;If yes, assumed right?
            CMP     AL,0DH
            JZ      BIOS_END
            CMP     AL,13H
            JZ      BIOS_END
            MOV     GRAPHICS_WIDTH,8            ;Else gotta be high resolution.

BIOS_END:   MOV     DS:VIDEO_MODE,AH            ;Store video mode.
            POP     DS                          ;Restore registers.
            POP     AX
            RET

;----------------------------------------------;
MOUSE_CONTROL PROC  FAR
            PUSH    AX                          ;Condition mask.
            PUSH    BX                          ;Button state.
            PUSH    DX                          ;Vertical cursor coordinate.
            PUSH    DI                          ;Vertical Mickeys.
            MOV     BP,CX                       ;Horizontal cursor coordinate.

            PUSH    CS                          ;Point to our data
            POP     DS
            PUSH    CS                          ; and extra segment.
            POP     ES
            CLD                                 ;All strings forward.

            MOV     AX,HORS_LAST                ;Retrieve last mickey count.
            MOV     HORS_LAST,SI                ;Last gets new count.
            SUB     SI,AX                       ;SI gets difference since last.
            JZ      VERTICAL                    ;If no change, done here.
            MOV     AX,HORS_REMAINDER           ;Else, retrieve remainder.
            CALL    LOOKUP                      ;Calculate adjusted mickeys.
            ADD     HORS_ADJUSTED,AX            ;Add to our mickey count.
            MOV     HORS_REMAINDER,DX           ;Store remainder for next time.

            MOV     CX,8                        ;Multiply count by 8.
            IMUL    CX
            MOV     SI,HORS_RATIO_REMAIN        ;Last ratio remainder.
            MOV     CX,HORS_RATIO               ;Mickeys per 8 pixels.
            CALL    SIGN_ADD_DIV                ;Calculate Mickey/pixels.
            MOV     HORS_RATIO_REMAIN,DX        ;Store remainder for next time.

            CMP     VIDEO_MODE,GRAPHICS         ;Graphics video mode?
            JNZ     HORS_TEXT                   ;If no, do text cursor.
            CMP     AX,0                        ;Else, are there any mickeys?
            JZ      VERTICAL                    ;If no, done here.
            MOV     CX,GRAPHICS_WIDTH           ;Retrieve resolution adjustment.
            JG      ADD_WIDTH                   ;Is it positive mickeys?
            NEG     CX                          ;If no, negate adjustment.
ADD_WIDTH:  ADD     AX,CX                       ;Add adjustment value.
            ADD     BP,AX                       ;Add result to cursor position.
            JMP     SHORT VERTICAL              ;Done here.

HORS_TEXT:  ADD     AX,HORS_CURS_REMAIN         ;Add last remainder.
            CWD                                 ;Convert to double word.
            MOV     SI,AX                       ;Store in SI.
            MOV     CX,CHAR_WIDTH               ;Divide by mouse
            IDIV    CX                          ; pixels/character (8 or 16).
            MOV     HORS_CURS_REMAIN,DX         ;Store remainder for next time.
            SUB     SI,DX                       ;Subtract remainder to get pixels
            ADD     BP,SI                       ;Add result to cursor position.

;----------------------------------------------;
VERTICAL:   POP     SI                          ;Retrieve vertical Mickeys.
            POP     BX                          ;Retrieve vertical coordinate.
            MOV     AX,VERT_LAST
            MOV     VERT_LAST,SI                ;Calculate vertical same as
            SUB     SI,AX                       ; horizontal.
            JZ      MOVE_CURSOR
            MOV     AX,VERT_REMAINDER
            CALL    LOOKUP
            ADD     VERT_ADJUSTED,AX
            MOV     VERT_REMAINDER,DX

            MOV     CX,8
            IMUL    CX
            MOV     SI,VERT_RATIO_REMAIN
            MOV     CX,VERT_RATIO
            CALL    SIGN_ADD_DIV
            MOV     VERT_RATIO_REMAIN,DX

            CMP     VIDEO_MODE,GRAPHICS
            JNZ     VERT_TEXT
            ADD     BX,AX
            JMP     SHORT MOVE_CURSOR
```

```
VERT_TEXT:  ADD     AX,VERT_CURS_REMAIN
            CWD
            MOV     SI,AX
            MOV     CX,8
            IDIV    CX
            MOV     VERT_CURS_REMAIN,DX
            SUB     SI,DX
            ADD     BX,SI

;----------------------------------------------;
MOVE_CURSOR: MOV    CX,BP                       ;New horizontal cursor coordinate
            MOV     DI,BX                       ;New vertical cursor coordinate
            MOV     AX,4                        ;Set Mouse Cursor.
            CALL    MOUSE_DRIVER
            POP     AX                          ;Retrieve Button state.
            POP     AX                          ;Retrieve Condition mask.
            TEST    AX,CALL_MASK                ;Is there a subroutine installed?
            JZ      MOUSE_END                   ;If no, done here.
            MOV     SI,HORS_ADJUSTED            ;Else, pass on vertical mouse
            MOV     DI,VERT_ADJUSTED            ; counts and horizontal mouse
            CALL    DWORD PTR INTERRUPT_SUB     ; counts to the subroutine.
MOUSE_END:  RET
MOUSE_CONTROL ENDP

;----------------------------------------------;
;INPUT: SI = MICKEYS; AX = Last remainder; Flags = sign of MICKEYS. ;
;OUTPUT: AX = Adjusted MICKEYS, DX = New remainder.                 ;
;----------------------------------------------;
LOOKUP:     PUSHF                               ;Save sign.
            JNS     EXCHANGE
            NEG     SI                          ;Absolute value of Mickeys.
EXCHANGE:   XCHG    AX,SI                       ;Store in AX for scan.
            MOV     CX,MULTIPLIER_LENGTH - 1    ;Length of table.
            MOV     DI,OFFSET RANGE             ;Point to table.
NEXT_ACCEL: SCASW                               ;Scan until Mickeys exceeds
            JB      GOT_ACCEL                   ; range.
            LOOP    NEXT_ACCEL
GOT_ACCEL:  POPF                                ;Retrieve sign.
            JNS     MULTIPLY
            NEG     AX                          ;Return sign to Adjusted Mickeys.
MULTIPLY:   MOV     DI,OFFSET MULTIPLIER_END    ;Point to multipliers.
            SHL     CX,1                        ;Retrieve multiplier for
            SUB     DI,CX                       ; appropriate range.
            MOV     CX,[DI]
            IMUL    CX                          ;Multiply.
            MOV     CX,10                       ;Divide to achieve implied
            CALL    SIGN_ADD_DIV                ; decimal point.
            RET

;----------------------------------------------;
; Calculates: signed double word DX:AX + SI / CX; OUTPUT: DX:AX=Result ;
;----------------------------------------------;
SIGN_ADD_DIV: XCHG  AX,SI                       ;Place SI in AX to sign extend.
            MOV     DI,DX                       ;DX:AX now in DI:SI.
            CWD                                 ;Sign extend AX to DX:AX.
            ADD     AX,SI                       ;Add to DX:DX, DI:SI.
            ADC     DX,DI
            IDIV    CX                          ;Divide DX:AX result by CX.
            RET                                 ; and return.

;           DISPOSABLE DATA
;           -----------------
SYNTAX      LABEL   BYTE
            DB      "Syntax: MOUSECTL [n ... n | filename | /U]",CR,LF
            DB      "n = up to 8 mouse multipliers with values between 0-32767"
            DB      CR,LF,"defaults = 5,6,10,15,22,30,50,70",CR,LF
            DB      "Implied decimal in values; ie. 5 = 0.5, 10 = 1.0",CR,LF
            DB      "filename - file with multiplier values",CR,LF
            DB      "/U = Uninstall"
CR_LF       DB      CR,LF,LF,"$"

NOT_ENOUGH  DB      "Not enough memory",CR,LF,"$"
NOT_FOUND   DB      "File not found",CR,LF,"$"
NO_MOUSE    DB      "Mouse driver not installed so "
NOT_INSTALLED DB    "MOUSECTL not installed",CR,LF,"$"
UNLOAD_MSG  DB      "MOUSECTL can't be uninstalled",CR,LF
            DB      "Uninstall resident programs in reverse order",CR,LF,"$"
ALLOCATE_MSG DB     "Memory allocation error",CR,LF,BELL,"$"
INSTALL_MSG DB      "Installed",CR,LF,"$"
UNINSTALL_MSG DB    "Uninstalled",CR,LF,"$"

;----------------------------------------------;
; Search memory for a copy of our code, to see if already installed. ;
;----------------------------------------------;
INITIALISE  PROC    NEAR
            CLD                                 ;All string operations forward.
            MOV     BX,OFFSET START             ;Point to start of code.
            NOT     BYTE PTR [BX]               ;Change a byte so no false match.
            XOR     DX,DX                       ;Start at segment zero.
            MOV     AX,CS                       ;Store our segment in AX.
NEXT_PARAG: INC     DX                          ;Next paragraph.
            MOV     ES,DX
            CMP     DX,AX                       ;Is it our segment?
            JZ      ANNOUNCE                    ;If yes, search is done.
            MOV     SI,BX                       ;Else, point to our signature
            MOV     DI,BX                       ; and offset of possible match.
            MOV     CX,16                       ;Check 16 bytes for match.
            REP     CMPSB
            JNZ     NEXT_PARAG                  ;If no match, keep looking.

;----------------------------------------------;
ANNOUNCE:   MOV     DX,OFFSET SIGNATURE         ;Display our signature.
            CALL    PRINT_STRING
            MOV     DX,OFFSET SYNTAX            ;And syntax.
            CALL    PRINT_STRING

;----------------------------------------------;
PARSE:      MOV     SI,81H                      ;Point to command line again.
NEXT_PARSE: LODSB                               ;Get a byte.
            CMP     AL,CR                       ;Is it carriage return?
            JZ      INSTALL                     ;If yes, done here.
            CMP     AL,"/"                      ;Is it switch character?
            JNE     CK_NUMBER                   ;If no, check if number.
            LODSB                               ;Else, get the switch.
            DEC     SI                          ;Adjust pointer.
            AND     AL,5FH                      ;Capitalise.
```

(MOUSECTL.ASM continues)

■ UTILITIES

```
        CMP     AL,"U"                  ;Is it "U"?
        JNE     NEXT_PARSE              ;If no, continue parsing.
        CALL    CK_INSTALLED            ;Else, are we installed?
        MOV     DX,OFFSET NOT_INSTALLED ;If no, exit with error message.
        JZ      MSG_EXIT
        JMP     SHORT UNINSTALL         ;Else, attempt to uninstall.

CK_NUMBER:
        CMP     AL,"0"                  ;Is it a number?
        JA      CK_FILENAME            ;If no, must be a filename.
        CMP     AL,"9"
        JB      CK_FILENAME
        DEC     SI                      ;Else, adjust pointer.
        JMP     SHORT LOAD_TABLE        ;Load the table with multipliers.

CK_FILENAME:
        CMP     AL,SPACE                ;Is it a delimiting character?
        JBE     NEXT_PARSE              ;If yes, continue parsing.
        PUSH    SI                      ;Else, save start.
FIND_END:
        LODSB                           ;Find the end and convert
        CMP     AL,SPACE                ; to ASCII.
        JA      FIND_END
        MOV     BYTE PTR [SI-1],0
        POP     DX                      ;Retrieve start.
        DEC     DX                      ;Adjust.
        MOV     AX,3D00H                ;Open file for reading.
        INT     21H
        MOV     DX,OFFSET NOT_FOUND     ;Exit with error message if
        JC      MSG_EXIT                ; not found.
        MOV     BX,AX                   ;Else, save handle.
        MOV     DX,OFFSET BUFFER        ;Point to buffer and
        MOV     CX,100                  ; read up to 100 characters.
        MOV     AH,3FH
        INT     21H
        MOV     AH,3EH                  ;Close the file.
        INT     21H
        MOV     SI,DX                   ;Point to buffer.
        MOV     BYTE PTR [SI+100],CR    ;Add ending carriage return.

LOAD_TABLE:
        MOV     DI,OFFSET MULTIPLIER    ;Point to multiplier table.
        MOV     CX,MULTIPLIER_LENGTH    ;Number of entries.
NEXT_MULT:
        LODSB                           ;Read a byte.
        CMP     AL,CR                   ;Ending carriage return?
        JZ      INSTALL                 ;If yes, done here.
        CMP     AL,"0"                  ;Is it delimiter?
        JB      NEXT_MULT               ;If yes, next byte.
        DEC     SI                      ;Else, adjust pointer.
        CALL    DECIMAL_HEX             ;Convert decimal to hex.
        STOSW                           ;Store the value.
```

```
        LOOP    NEXT_MULT               ;Retrieve all values.

INSTALL:
        CALL    CK_INSTALLED            ;Check if already installed.
        JZ      CK_MOUSE                ;If no, see if mouse installed.
        OR      AL,AL                   ;Else, done.
        JMP     SHORT EXIT              ;Exit with ERRORLEVEL = 0.

;------------------------------------------------------------
; Exit. Return ERRORLEVEL code 0 if successful, 1 if unsuccessful. ;
;------------------------------------------------------------
MSG_EXIT:
        CALL    PRINT_STRING
ERROR_EXIT:
        MOV     AL,1                    ;ERRORLEVEL = 1.
EXIT:
        MOV     AH,4CH                  ;Terminate.
        INT     21H

;------------------------------------------------------------
; This subroutine uninstalls the resident MOUSECTL.COM. ;
;------------------------------------------------------------
UNINSTALL:
        MOV     CX,ES                   ;Save segment in CX.
        MOV     AX,3533H                ;Get interrupt 33.
        INT     21H
        CMP     BX,OFFSET NEW_INT_33    ;Has it been hooked by another?
        JNE     UNINSTALL_ERR           ;If yes, exit with error message.
        MOV     BX,ES
        CMP     BX,CX                   ;Is the segment vector same?
        JNE     UNINSTALL_ERR           ;If no, exit with error message.

        MOV     AX,3510H                ;Get interrupt 10.
        INT     21H
        CMP     BX,OFFSET NEW_INT_10    ;Has it been hooked by another?
        JNE     UNINSTALL_ERR           ;If yes, exit with error message.
        MOV     BX,ES
        CMP     BX,CX                   ;Is the segment vector same?
        JNE     UNINSTALL_ERR           ;If no, exit with error message.

        MOV     AH,49H                  ;Return memory to system pool.
        INT     21H
        MOV     DX,OFFSET ALLOCATE_MSG
        JC      MSG_EXIT                ;Display message if problem.

        MOV     DS,ES:OLD_INT_33[0]     ;Restore old INT 33.
        MOV     DX,ES:OLD_INT_33[2]
        MOV     AX,2533H
        INT     21H
        MOV     DS,ES:OLD_INT_10[0]     ;Restore old INT 10.
        MOV     DX,ES:OLD_INT_10[2]
        MOV     AX,2510H
```
(MOUSECTL.ASM continues)

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▪ UTILITIES

```
            INT     21H

            XOR     AX,AX               ;Mouse Reset.
            INT     33H
            PUSH    CS
            POP     DS                  ;Point to our data.
            MOV     DX,OFFSET UNINSTALL_MSG  ;Display uninstall message.
            CALL    PRINT_STRING
            XOR     AL,AL               ;Exit with ERRORLEVEL = 0.
            JMP     EXIT

UNINSTALL_ERR: MOV   ES,CX               ;If error, exit
            MOV     DX,OFFSET UNLOAD_MSG ; with error message.
            JMP     MSG_EXIT

;-----------------------------;
; This is the install procedure. ;
;-----------------------------;
CK_MOUSE:   MOV     AX,3533H            ;Else, get INT 33 vector.
            INT     21H
            MOV     AX,ES
            OR      AX,AX               ;If vector zero, no mouse driver.
            MOV     DX,OFFSET NO_MOUSE
            JZ      MSG_EXIT
            MOV     AL,ES:[BX]
            CMP     AL,IRET_CODE
            JZ      MSG_EXIT
            MOV     OLD_INT_33[0],BX    ;Save old interrupt.
            MOV     OLD_INT_33[2],ES
            MOV     DX,OFFSET NEW_INT_33 ;Install new interrupt.
            MOV     AX,2533H
            INT     21H
            XOR     AX,AX
            INT     33H                 ;Initialize driver.
            CALL    GET_BIOS_DATA       ;Get video mode.

            MOV     AX,3510H            ;Get INT 10 vector.
            INT     21H
            MOV     OLD_INT_10[0],BX    ;Save old interrupt.
            MOV     OLD_INT_10[2],ES
            MOV     DX,OFFSET NEW_INT_10 ;Install new interrupt.
            MOV     AX,2510H
            INT     21H

            MOV     AX,DS:[2CH]         ;Get environment segment.
            MOV     ES,AX
            MOV     AH,49H              ;Free up environment.
```

```
            INT     21H

            MOV     DX,OFFSET INSTALL_MSG ;Display install message.
            CALL    PRINT_STRING
            MOV     DX,OFFSET SYNTAX    ;End of resident portion.
            ADD     DX,15               ;Round up.
            MOV     CL,4
            SHR     DX,CL               ;Convert to paragraphs.
            MOV     AX,3100H            ;Return error code of zero.
            INT     21H                 ;Terminate but stay resident.
INITIALIZE  ENDP

;-----------------------------------------------;
; OUTPUT: ZR = 1 if not installed; ZR = 0 if installed. ;
;-----------------------------------------------;
CK_INSTALLED: MOV   AX,ES
            MOV     BX,CS
            CMP     AX,BX               ;Compare segments.
            RET

;-----------------------------------------------;
; INPUT: SI points to decimal number; OUTPUT: AX = hex number ;
;-----------------------------------------------;
DECIMAL_HEX: XOR    BX,BX
NEXT_DECIMAL: LODSB                     ;Get a character.
            SUB     AL,"0"              ;ASCII to binary.
            JC      DECIMAL_END         ;If not between 0 and 9, skip.
            CMP     AL,9
            JA      DECIMAL_END
            CBW                         ;Convert to word.
            XCHG    AX,BX               ;Swap old and new number.
            MOV     DX,10               ;Shift to left by multiplying
            MUL     DX                  ; last entry by ten.
            ADD     BX,AX               ;Add new number and store in BX.
            JMP     NEXT_DECIMAL
DECIMAL_END: MOV    AX,BX               ;Return in AX.
            DEC     SI                  ;Adjust pointer.
            RET

;-----------------------------------------------;
PRINT_STRING: MOV   AH,9
DOS_INT:    INT     21H                 ;Print string via DOS.
            RET

BUFFER      EQU     $
_TEXT       ENDS
            END     START
```

(MOUSECTL.ASM ends)

■ UTILITIES

```
100 REM - BASIC PROGRAM TO CREATE B:MOUSECTL.COM
110 CLS:PRINT "Creating B:MOUSECTL.COM ": OPEN "B:MOUSECTL.COM " AS #1 LEN = 1
120 FIELD #1, 1 AS A$: CHECKSUM#=0
130 FOR I = 1 TO   104
140 LINESUM#=0: LOCATE 2,3: PRINT "Countdown: "  104 - I ;
150 FOR J = 1 TO 16: READ BYTE$: BYTE = VAL("&H" + BYTE$)
160 CHECKSUM# = CHECKSUM# + BYTE: LINESUM# = LINESUM# + BYTE
170   IF (BYTE < 256) THEN LSET A$=CHR$(BYTE): PUT #1
180 NEXT J
190 READ LINETOT$: LINECHECK# = VAL("&H"+LINETOT$)
200 IF LINECHECK# = LINESUM# THEN GOTO 220
210 LOCATE 4,2: PRINT "Error in line #"  ; 265 + 10 * I: GOTO 260
220 NEXT I
230 CLOSE: READ FILETOT$ : FILECHECK# = VAL(FILETOT$)
240 IF CHECKSUM# <> FILECHECK# THEN GOTO 260
250 PRINT: PRINT "B:MOUSECTL.COM created successfully": END
260 PRINT: PRINT "B:MOUSECTL.COM not valid": END
```

MOUSECTL.BAS: *Running this BASIC program will also create MOUSECTL.COM if you'd prefer not to work with a macro assembler.*

underside rotates a wheel, which in turn operates a counter. The mouse wheel is analogous to the wheel you see highway crews pushing down the center line to measure a road's length. Whereas the highway counter measures feet, the mouse uses a unit of measure called a *mickey*. There are approximately 200 mickeys per inch of mouse movement. The mouse hardware regularly reports the number of mickeys it accumulates to the mouse driver. The sign of the sum identifies the direction of movement. For the serial mouse, the report rate is about 40 times per second. Naturally, the faster you move the mouse, the more mickeys accumulate between reports.

The mouse driver converts the mickey counts into screen pixel units. A *pixel* (picture element) is the smallest addressable display unit. The number of mickeys required to move the cursor one pixel can be adjusted through a mouse-driver function call. The default mickey-to-pixel ratio is 1:1 on the *x*-axis and 2:1 on the *y*-axis. The 2:1 ratio in the vertical direction compensates for the screen's aspect ratio, because there are approximately twice as many pixels in the horizontal direction. For example, the EGA 80 by 25 text resolution is 640 by 350.

In a graphics mode the cursor—usually an arrow—can be moved one pixel at a time. In a text mode, however, the cursor is usually implemented by changing the attribute of the character under it. Thus, the

■ The mouse uses a unit of measure called the mickey. There are 200 mickeys to the inch.

cursor must move in one-character units. For example, an EGA character box is 8 by 14 pixels, so the smallest distance the text cursor can move is 8 pixels horizontally and 14 vertically. For the text cursor, therefore, the mouse must move 8 mickeys before it can move one character to the right or left.

MOUSECTL works by intercepting the mickey counts en route from the mouse to the mouse driver and adjusting them according to the lookup table shown in Figure 1. If the mouse hardware reports that the mouse has moved by 11 mickeys since its last report, for example, MOUSECTL looks in the table and sees that 11 falls in the range between 9 and 12. The high value of the range in which the mickey count falls (12 in this example) corresponds in the table to a multiplier of 22. The multiplier values have an implied decimal point, however, which means the 22 is actually interpreted as 2.2. Thus, the reported mickey count of 11 is multiplied by 2.2,

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PC Multiplier Table

Range values	0	3	5	7	9	12	23	32	and above
Multiplier values		5	6	10,	15	22	30	50	70

Figure 1: *MOUSECTL multiplies the actual mickey counts within the range values shown by the largest corresponding multiplier value. The multipliers have an implied decimal. Thus, for example, a mickey value of 11 fits between 9 and 12 in the range line and so is multiplied by 2.2 (not 22), resulting in an adjusted mickey total of 24.2.*

PC Charting the Gain: Mouse Movement with and Without MOUSECTL.COM
(Measured in mickeys)
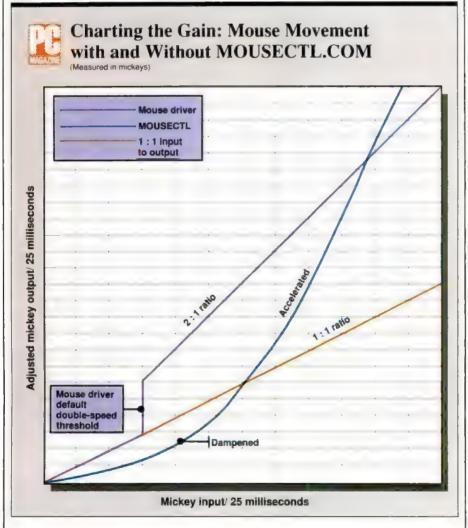
Figure 2: *Mickey input is accumulated by the mouse driver from the mouse hardware 40 times per second (every 25 milliseconds). The mickey output an application actually sees is adjusted by either the mouse driver or MOUSECTL. Without MOUSECTL, the mouse driver's default double-speed threshold of 64 mickeys per second results in doubling all mickey output starting at an input of 3. MOUSECTL adds a larger range of sensitivity by decreasing the reported mickeys for slow movements and increasing them for fast movements.*

which results in an adjusted count of 24.2 mickeys. This is truncated to an integer value of 24 and the remainder, $^2/_{10}$ of a mickey, is added into the calculation of the next mickey report.
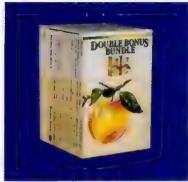
Converting an original mickey count of 11 into 24 will obviously make the mouse cursor move farther than normal. On the other hand, a mickey count of 3 will use the first multiplier, 0.5 (with the implied decimal point), and 3 times 0.5 results in reducing the reported mickey count to 1, with a remainder of one half. When moving slowly, therefore, the mouse will have to be moved twice as far as normal, making the cursor less sensitive. At the top end of the scale, a large mickey count approaching 32 with a multiplier of 5.0 results in a whopping 160 mickeys. Keep in mind that the faster the mouse is moved the greater the number of mickeys that can accumulate between mickey reports. Moving the mouse slowly results in a damped cursor response, while a jerk of the mouse sends the cursor quickly across the screen.

CHANGING MULTIPLIERS You can change the multiplier values at any time by listing new values as MOUSECTL arguments at the DOS command line. Alternatively, you can put the desired values in a one-line text file and add its filename when you invoke MOUSECTL. By storing values in different files you can then easily create customized multiplier rates for different applications. In either case the maximum number of multipliers is eight, corresponding to eight ranges. When you supply fewer than eight n values, they are placed in the table from left to right, leaving the remaining values, unchanged. The values for n can be delimited by commas or spaces. The default multiplier values plot a curve that damps the mouse for slow movements and accelerates it for fast movements, as depicted in Figure 2. If you don't like the default values, it's easy to experiment. You don't have to uninstall to change the values; just enter MOUSECTL at the DOS prompt again with the new values. For example, to increase the damping effect of the first three default multipliers (5, 6, 10) to 3, 4, 6, just enter

MOUSECTL 3 4 6

at the DOS prompt.

■ UTILITIES

A quick and easy way to test a new set of values is to load the mouse driver and MOUSECTL and then turn the mouse cursor on. The following DEBUG instructions create a program, MCURSOR, that will turn on the mouse cursor:

```
N MCURSOR.COM
A
MOV AX,1
INT 33
RET

RCX
6
W
Q
```

One additional caveat about using MOUSECTL is in order. You must be careful not to load an *invalid* file of multipliers into the program. If, for example, you were to enter

`MOUSECTL CONFIG.SYS`

the mouse will not work at all. This has the consequence that if you enter a program like *Ventura Publisher*, which requires that you use the mouse to exit, you'll be stuck and will have to reboot. If you load an invalid file outside of such programs as *Ventura*, however, you can rescue yourself simply by typing in new multiplier values or loading a valid multiplier file. This shows the kind of limitation that comes with the territory when you're programming tiny utilities in assembly language.

UNDERSTANDING MOUSECTL As indicated earlier, the reason that MOUSECTL works only with the Microsoft and IBM mouse drivers lies in a subtle documentation error in the *Microsoft Mouse Programmer's Reference Guide*. The error is in the description of one of the mouse function calls supported by compatible mouse drivers. The mouse function calls work much in the manner of DOS Interrupt 21h function calls. The mouse service desired by an application is requested by placing the function number in the AX register. Any additional required information is placed in the remaining registers, and an Interrupt 33h call is issued. The only difference between a DOS and a mouse-function call is that DOS calls are serviced by the kernel (IBMBIO.COM and IBMDOS.COM, the hidden files loaded at boot time), while mouse calls are
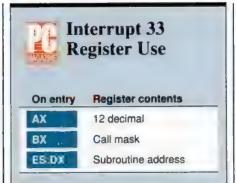
Figure 3: *The register setup before issuing an interrupt 33h, mouse function call 12 (Set Interrupt Subroutine Call Mask and Address Register).*

serviced either by the CONFIG.SYS device driver, by MOUSE.SYS, or by its equivalent TSR version, MOUSE.COM.

Function 12, Set Interrupt Subroutine Call Mask and Address, is the incorrectly documented call. The purpose of this function is to set up a subroutine that the mouse driver will call when a selected set of mouse events occurs. The intent is that the mouse driver will call an application's subroutine only when the state of the mouse has changed. Such a procedure uses an interrupt-driven subroutine, which is a much more efficient way for an application to get mouse input than would be the alternative

of setting up a polling loop that repeatedly asks the driver for the status of the mouse. An interrupt-driven application doesn't waste time inquiring until it gets a signal that it has something useful to do. Using function 12 is similar to installing a keyboard interrupt handler via an Interrupt 9 hook—the hotkey monitor technique used by TSRs—versus the inefficient method of making multiple Interrupt 16 keyboard status calls.

Function 12 is issued by an application with a call mask and the address of the subroutine, as shown in Figure 3. The call mask itself, shown in Figure 4, is a word whose individual bits are set to indicate which mouse event(s) the subroutine wants to be notified about. For example, after an application makes a function 12 call with a call mask = 10d (01010b), the mouse driver will interrupt whatever is going on and pass control to the subroutine whenever either mouse button is pressed. The mouse driver passes the subroutine a complete mouse status report in the registers as shown in Figure 5.

Now to the error. The documentation states that when the first bit of the call mask is set, the subroutine will be called whenever the "Cursor position changes" (Figure 4). In reality, however, the subroutine is called whenever the *mouse position* changes; that is, whenever the mickey
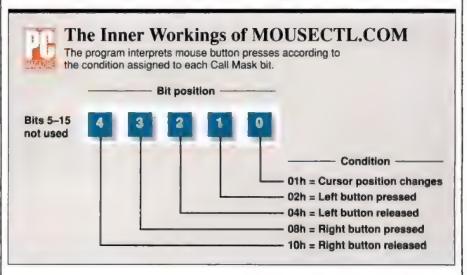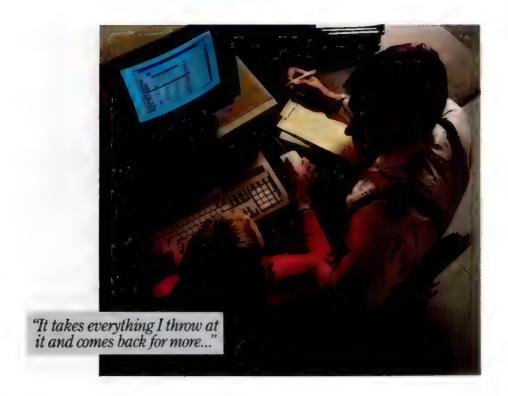
Figure 4: *You set the individual bits of the mouse function 12 call mask for each condition under which you want the mouse driver to call your subroutine. You should note that for the mouse drivers that are supplied by Microsoft and IBM, the condition of the first bit is actually "Mouse position changes" not "Cursor position changes."*

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■ PC MAGAZINE'S FREE UTILITY: A SUMMARY

MOUSECTL BY MODEM

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Tear out and hole-punch the command summary on this page and add it to your DOS manual.

MOUSECTL Command

Michael J. Mefford	April 25, 1989 (Utilities)

Purpose: Provides multiple sensitivity settings for achieving more precise and smooth control of IBM and Microsoft mice.

Format: `MOUSECTL [n ... n | filename | /U]`

Remarks: MOUSECTL is a memory-resident utility that can be loaded either at the DOS prompt or as part of an AUTOEXEC.BAT file. It can be used only with IBM or Microsoft mouse drivers and must be loaded after either MOUSE.SYS or MOUSE.COM. MOUSECTL can be deinstalled by entering the command with the /U switch.

The optional n parameters consist of up to eight "multiplier" values between 0 and 32767, which are used to modify the mouse sensitivity. The default values are 5,6,10,15,22,30,50,70. Other values for n may be entered using either a space or a comma delimiter. The n values are entered into a lookup table from left to right; if less than eight numbers are entered, those already in the table remain in force.

The range values represent the number of mickeys ($1/200$-inch increments) the mouse is actually moved during its 25-millisecond reporting period. The multiplier values (n) are divided by 10 and then multiplied by the range value to determine the adjusted number of mickeys reported to the application program. For example, an actual motion of 5 mickeys multiplied by 0.6 results in 3 mickeys being reported, slowing the mouse movement to obtain more precise control for drawing. A movement of 30 mickeys in one 25-millisecond period will be multiplied by 5.0, so 150 mickeys will be reported, moving the cursor very rapidly for page scanning.

Note: Because *Microsoft Windows* loads its own mouse driver, MOUSECTL cannot be used with *Windows* utilities or with programs (such as *PageMaker*) that must, rather than may, be run under *Windows*.

Available for downloading from PC MagNet (see the sidebar "MOUSECTL by Modem" in the Productivity section), MOUSECTL.COM is already compiled and ready to run. As an alternative, MOUSECTL.COM can be created from either of two program files that are both printed in the article and are available for downloading from PC MagNet. MOUSECTL.BAS will automatically create MOUSECTL.COM when run once in BASIC. To create MOUSECTL.COM from the MOUSECTL.ASM source code requires use of a macro assembler (IBM or Microsoft, Version 2 or later) and the following commands:

```
MASM MOUSECTL;
LINK MOUSECTL;
EXE2BIN MOUSECTL MOUSECTL.COM;
```

Commands

■ UTILITIES

Subroutine Register Use

Register	Information
AX	Condition mask (similar to the call mask except a bit is set only for the condition that has occurred)
BX	Button state
CX	Horizontal cursor coordinate
DX	Vertical cursor coordinate
SI	Horizontal mickey counts
DI	Vertical mickey counts

Figure 5: *When the subroutine is called by the mouse driver, the mouse state is passed in the registers. Note: in some versions of the* Microsoft Mouse Programmer's Reference Guide, *the SI and DI registers are incorrectly documented as DI = horizontal and SI = vertical mickey counts.*

count changes, which is not the same thing.

To illustrate the difference, let's look at how MOUSECTL works. MOUSECTL keeps the mouse driver from moving the cursor, in order to adjust the movement. To accomplish this, MOUSECTL installs a subroutine with a call mask of 1 so that it can intercept any mouse movement and adjust the placement of the cursor. Function 12 is ideal for this, since the mouse driver passes all the pertinent information to the subroutine. The mickey counts passed to MOUSECTL in the SI and DI registers are multiplied by the appropriate lookup value and added to the current cursor coordinates passed in the CX and DX registers. The MOUSECTL program then simply moves the cursor to the new location via mouse function 4, Set Mouse Cursor Position.

There is one hitch in the driver that MOUSECTL must overcome. Before the mouse driver passes the control to MOUSECTL, it first moves the cursor itself. If MOUSECTL were also to move the cursor, the cursor would be all over the place. Function 15, Set Mickey/Pixel ratio, is summoned to the rescue. Function 15 tells the mouse driver how many mickeys the mouse must travel before the cursor will be moved. The ratio can be anywhere from 1 to 32,767 mickeys per 8 pixels. MOUSECTL sets the ratio to the maximum (32,767), which effectively disables the mouse driver from moving the cursor. Even though the mouse driver is prevented from moving the cursor, it still calls MOUSECTL and allows MOUSECTL to control the cursor. This is despite the documentation's claim that the subroutine will be called only when the "Cursor position changes."

Logitech and Mouse Systems (and, I assume, most other mouse drivers) interpreted the "Cursor position changes" mask quite literally. Since MOUSECTL sets the Mickey/Pixel ratio very high, these mouse drivers never change the cursor position. Because the cursor never moves, it never calls the MOUSECTL program and, therefore, the cursor remains frozen on the screen.

You can decide for yourself whether the real error is in the documentation or in the implementation. The three mouse companies with whom I talked certainly had their opinions and did their share of finger pointing. One view was that an application makes decisions based on cursor position (pull down menus, for example) instead of changes in mouse position. On the other hand, the fact that mickeys are passed to the event handler suggests that the mask description should have read "mouse position changes," not "cursor position changes." If all that a subroutine was interested in was cursor position, it would have no use for the mickey values. Presumptions on the part of designers of system software about how an application will utilize the software can lead to trouble.

When I first hit the documentation error I tried what seemed to be a promising new

■ UTILITIES

tactic to work around its consequences. Rather than relying on function 12 to gain control, I used an Interrupt 8 (timer tick) hook that polled the mouse driver. The Interrupt 8 handler retrieved the mickey counts and set the cursor position on every timer tick. Although less efficient, MOUSECTL would get control often enough to move the cursor when the mouse moved. Alas, my experiment failed miserably.

Why? It turns out that the mouse drivers, like DOS, are not reentrant. The mouse driver is driven by the low-priority serial interrupt. When a mouse event occurs (similar to what happens when you press a key), the hardware generates an in-

---

■ The mouse driver is driven by the low-priority serial interrupt. When a mouse event occurs, the hardware generates an interrupt so that the event can be processed.

---

terrupt so it can be processed. The timer tick interrupt has the highest priority so occasionally MOUSECTL gained control via its Interrupt 8 hook and called the mouse driver to get the mickey count while the mouse driver was busy processing its serial interrupt. The mouse driver got confused and the cursor was not properly updated. (A simple CLI by the mouse driver while doing critical calculations would have protected it from higher priority interrupts.) Microsoft admits to the mouse driver reentry problem as well as the function 12 documentation error.

For programmers, I should at least mention two other documentation errors I discovered during the development of MOUSECTL. My version of the *Microsoft Guide* says that function 12 passes horizontal mickeys in the DI register and vertical mickeys in the SI register. It's

■ UTILITIES

actually the other way around: horizontal in SI and vertical in DI, which is consistent with function 11, Read Mouse Motion Counters.

The second discrepancy is in the description of function 4, Set Mouse Cursor Position. The guide states: "If the screen is not in a mode with a cell size of 1×1, the parameter values are rounded to the nearest horizontal or vertical coordinate values permitted for the current screen mode." For example, in a text mode, the cursor must be on the boundary of the character

---

■ Mouse Systems's latest driver has a built-in mouse multiplier similar to MOUSECTL. But the IBM or Microsoft mouse drivers could use the tune-up of MOUSECTL.

---

box. Characters are 8 pixels wide, so attempting to set the cursor at a horizontal pixel coordinate of, say, 23 should set the cursor at coordinate 24, rounding up to the nearest multiple of 8. In fact, however, the mouse driver *truncates* rather than rounds, and so sets the cursor at coordinate 16. As you can imagine, until uncovered, this error caused some mysterious results in MOUSECTL.

CLOSING NOTES MOUSECTL hooks two interrupts, Interrupt 33h and Interrupt 10h (the same interrupts the mouse driver hooks), because of side effects of the function calls. The amply documented assembly listing for the functions that relate to MOUSECTL explain this. Mouse Systems's users will be pleased that that company's latest driver has a built-in mouse multiplier that works similarly to MOUSECTL. But if you have the IBM or Microsoft mouse driver, pull in to pit row and stick MOUSECTL under your hood. Your mouse could use a tune-up. ▧

■ ENVIRONMENTS ■ CHARLES PETZOLD

BOOTING OS/2 1.1 FROM A FLOPPY DISK

IBM's OS/2 1.1 manual shows you how to boot DOS from a floppy disk, but if you still have to live primarily in the DOS world, here's how to get OS/2 going on an occasional basis.

IBM began shipping OS/2 1.1 updates to registered users of OS/2 1.0 in November 1988. I could tell when people began receiving their updates by the inquiries I started getting on PC MagNet. All of a sudden, people wanted to know when I would show them how to install the new version of OS/2 to boot from a floppy diskette, as I had done for OS/2 1.0 ("Cleaning Up After IBM," PC Lab Notes, *PC Magazine*, April 12 and 26, 1988).

At first I was hesitant about doing this. If you want the ability to boot up either DOS or OS/2, it seems to make more sense to install OS/2 on the hard disk and boot DOS from a floppy.

Further, IBM's installation procedure for OS/2 1.1 is much improved. The installation process leaves far fewer files in the root directory and produces a more rational subdirectory structure. Thus there's no reason to reorganize the OS/2 1.1 directories, the topic that occupied most of my discussion in last year's articles.

Still, there are evidently some people who want to keep good old-fashioned DOS installed on their hard disks but who would nonetheless like to boot up OS/2 1.1 occasionally. So, in this column we'll examine how you can boot OS/2 1.1 from a floppy diskette.

If you have IBM OS/2 1.1; an IBM 80286 or 80386-based PC; 2MB of extended memory; 8MB of free space on drive C:; and an EGA, VGA, or 8514/A display, you're ready to do so.

By way of overview, you'll first install OS/2 1.1 on your hard disk, then create a floppy diskette to boot OS/2, and finally reinstall DOS on your hard disk. If you feel at all leery about doing any of this, don't do it.

Let me also emphasize that what I say here applies only to IBM OS/2 1.1, not other manufacturers' versions of OS/2.

STEP 1: PREPARATION First, make a bootable DOS diskette that contains your normal CONFIG.SYS and AUTOEXEC .BAT files. You may need to change these two files slightly to include explicit references to drive C:. For example, if your CONFIG.SYS file has a line that reads

```
DEVICE=\DOS\ANSI.SYS
```

change it to read

```
DEVICE=C:\DOS\ANSI.SYS
```

Next, copy SYS.COM onto this diskette so you can later use it to reinstall DOS on your hard disk. Try booting DOS from this diskette to be sure it works.

■ IBM's installation process for OS/2 1.1 leaves far fewer files in the root directory and produces a more rational subdirectory structure.

You should now clean up the root directory of drive C: so that it contains only directories and no files. The easiest way to do this is to create a directory named C:\DOSROOT, copy everything from the root directory into it, and then delete the files in the root directory, thus:

```
MD C:\DOSROOT
COPY C:\*.* C:\DOSROOT
DEL C:\*.*
```

If the CONFIG.SYS or AUTOEXEC .BAT files on your bootable DOS diskette refer to files in the root directory, you'll have to change the references to C:\DOS-ROOT instead. Before continuing, check once again that you can boot DOS from this diskette and that the root directory is clean of files.

STEP 2: NORMAL INSTALLATION
Next, install OS/2 1.1 on your hard disk. You simply boot up the OS/2 1.1 "Installation Diskette" and follow the instructions. The installation is just about foolproof and takes about 20 minutes.

As you may know, OS/2 1.0 was shipped on four high-density diskettes. OS/2 1.1 is shipped on five diskettes. Is it really possible to fit all the additional OS/2 1.1 files on one high-density diskette? Of course not! Most of the OS/2 1.1 files are stored in a "packed" format and are unpacked during installation. This is one reason I suggest you go through the normal OS/2 1.1 installation. Although it may be possible to copy files from the diskettes to your hard disk into the proper directories and run UNPACK on them, it would be

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difficult. The installation program also creates a CONFIG.SYS file.

You should now be able to boot up OS/2 1.1 from your hard disk and to boot DOS from a floppy diskette. Since that's exactly the opposite of what you want to do, let's continue.

STEP 3: LOOK AROUND When you first boot up OS/2 1.1, the initial screen has a copyright notice and a five-digit number. In the case of the version of OS/2 1.1 shipped by IBM beginning October 31, 1988, this number is 88300.

This is a "build date," the date that the operating system was compiled, assembled, and linked to produce the "golden masters" that were then copied for distribution. The "88" stands for 1988, and the "300" indicates the 300th day of 1988, October 26th. You'll notice that the installed OS/2 1.1 files have the same date.

OS/2 1.1 takes about a minute to boot from a hard disk, and it leaves you in a Presentation Manager session with the Start Programs window in mid-screen. From here, you can run the "Introducing OS/2" program, the Presentation Manager File System, or several other programs. If you feel more comfortable using a command line, you can start up an "OS/2 full screen command prompt" or "OS/2 windowed command prompt" session.

IBM's OS/2 1.1 installation program stores files in six directories:

```
C:\
C:\OS2
C:\OS2\INSTALL
C:\OS2\INTRO
C:\OS2\DLL
C:\OS2\SYSTEM
C:\SPOOL
```

The C:\OS2 directory contains most of the external commands and user-installable device drivers. C:\OS2\INSTALL has an installation program that IBM uses for OS/2 1.1 itself and for some other IBM software packages. C:\OS2\INTRO contains the "Introducing OS/2" program. C:\OS2\DLL has dynamic link libraries, including the printer driver and font files.

Several system programs and message files reside in C:\OS2\SYSTEM. This directory is also used to hold the SWAPPER.DAT file (for disk swapping) that OS/2 creates each time it boots up. The

OS/2 1.1 Files in the C: Root Directory

Filename	Comment
OS2LDR	Hidden file
OS2KRNL	Hidden file
ABIOS.SYS	PS/2 only
CLOCK0x.SYS	Clock device driver
DISK0x.SYS	Disk device driver
KBD0x.SYS	Keyboard device driver
PRINT0x.SYS	Printer device driver
SCREEN0x.SYS	Screen device driver (text mode)
*.BIO	Eight files, PS/2 only
CONFIG.SYS	
COMMAND.COM	Not really needed
AUTOEXEC.BAT	DOS startup commands

Figure 1: *These files are stored in the C: root directory after installing OS/2 1.1.*

C:\SPOOL directory is used for temporary files created by the print spooler.

THE C: ROOT DIRECTORY The installation program for IBM's OS/2 1.1 leaves far fewer files in the root directory than did the one for Version 1.0. Most of the files that end up in the root are those that OS/2 1.1 needs before it begins reading CONFIG.SYS. The CONFIG.SYS file contains directory paths for other files needed to complete the boot process. (The LIBPATH statement in CONFIG.SYS tells OS/2 where to find the dynamic link library files, for example.) The table in Figure 1 lists the files that are in the root directory of drive C:.

OS2LDR (loader) and OS2KRNL (kernel) correspond to the two DOS hidden files named (in IBM PC-DOS) IBMBIO.COM and IBMDOS.COM. OS2LDR is 4K in length and OS2KRNL is about 280K. Most of the entry points for the OS/2 functions that begin with the Dos prefix are in OS2KRNL. This file also supports OS/2's DOS compatibility box.

The installation program stores COMMAND.COM (used for the DOS compatibility box) in the root directory and in the C:\OS2 directory. The SHELL statement in CONFIG.SYS uses the copy in C:\OS2. I don't know why it also appears in the root

directory. Perhaps some DOS application programs expect it to be there.

OPTIONAL ENHANCEMENTS You'll notice that SET commands are now allowed in CONFIG.SYS. These commands create an environment that generally is passed to every OS/2 program you run, including the CMD.EXE command-line interpreter. You may also want to create a batch file specifically for any CMD.EXE session you start from the Start Programs window. Customarily, this file is called OS2INIT.CMD.

If you create an OS2INIT.CMD file that includes other directories in the PATH environment string (for example), you can add these to the PATH string specified in CONFIG.SYS by using

```
PATH=%PATH%; [other directories]
```

You need to tell OS/2 to use OS2INIT.CMD as a parameter to CMD.EXE. In Start Programs, highlight the "OS/2 full screen command prompt" line with the mouse or keyboard, and select Change from the Program menu. A dialog box appears. In the Parameters field, enter

```
/K \OS2INIT.CMD
```

and press the Change button. Repeat this for the "OS/2 windowed command prompt" line. The OS/2 command-line sessions then execute the commands in OS2INIT.CMD when they are started.

If you create a STARTUP.CMD file in the root directory, OS/2 will start up an OS/2 windowed command-prompt session when you boot up. At the least, STARTUP.CMD should probably contain

```
CALL OS2INIT.CMD
```

STARTUP.CMD can also include START commands to start OS/2 programs automatically when you boot the system.

STEP 4: A BOOTABLE OS/2 FLOPPY The OS/2 1.1 FORMAT command does not support the creation of a bootable floppy diskette, and SYS is not even included in this OS/2 version. We need another way to make a bootable OS/2 diskette. Of the five diskettes included in IBM's OS/2 1.1 release, only the one labeled Installation Diskette is bootable, so start with it and follow these steps:

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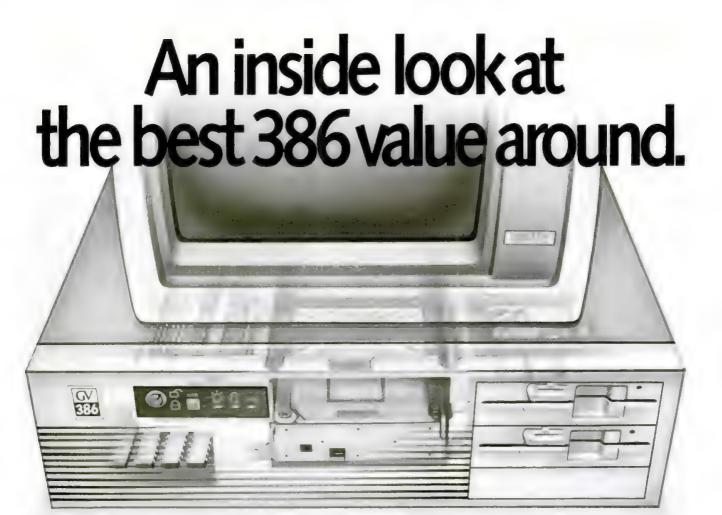
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■ ENVIRONMENTS

■ Use DISKCOPY A: A: to copy the Installation Diskette to a blank high-density diskette, swapping the source and target diskettes as instructed. I'll refer to the resulting target copy as the Floppy Boot diskette.

■ With the Floppy Boot diskette in drive A:, delete all the files on it *except* the two hidden files, OS2LDR and OS2KRNL, with the DEL A: *.* command.

■ Now copy all the files from the root directory of drive C: to the Floppy Boot diskette by issuing COPY C:*.* A:
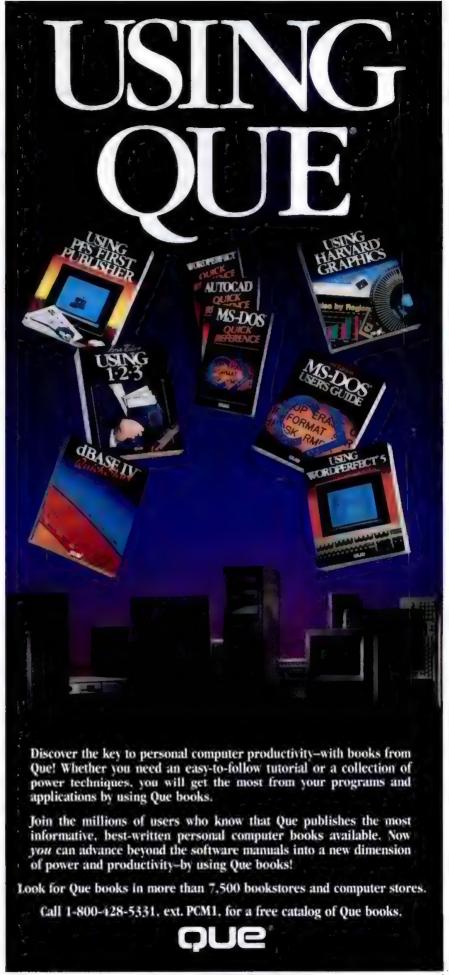
At this point you should be able to boot OS/2 1.1 from the Floppy Boot diskette.

STEP 5: CLEAN UP THE C: ROOT
After you've established that you can boot OS/2 1.1 from the Floppy Boot diskette, you can delete all the OS/2 files from the root directory of drive C:, *including* OS2LDR and OS2KRNL.

To delete OS2LDR and OS2KRNL, however, you must change their attributes so that they are no longer hidden, system, nor read-only. You can do this from the PM File System program. Open a window for the root directory of drive C: and select the two files. Then select Change Attributes from the File menu and leave all the boxes unchecked. You can delete all the files in the root directory by highlighting them in this window (do *not* highlight the subdirectories) and pressing the Del key.

At this point you'll probably be tempted to check that you can still boot OS/2 from your Floppy Boot diskette. *Don't do it!* Since you have just deleted the OS/2 hidden files (OS2LDR and OS2KRNL), but haven't yet restored the equivalent DOS hidden files (IBMBIO.COM and IBM-DOS.COM) to the specific location they must occupy on the hard disk in order to boot up DOS, you'll be in for trouble if you do. Each time OS/2 boots, it creates a large file called SWAPPER.DAT, which (as its name implies) is used for virtual memory swapping. If you boot up OS/2 at this point, the new SWAPPER.DAT file will usurp the specific area on the hard disk needed by IBMBIO.COM and IBMDOS .COM. So, don't restart the system until *after* Step 6 (below). If you've done so by accident, before you go to the next step, delete SWAPPER.DAT. It's in the \OS2\SYSTEM subdirectory.

■ **ENVIRONMENTS**

STEP 6: REINSTALL DOS You can now boot up DOS from the diskette you created earlier and run the SYS command to reinstall DOS on the hard disk. To get everything back to the way you had it, copy the files from the C:\DOSROOT directory back into the root directory with

```
COPY C:\DOSROOT\*.* C:\
```

Now simply delete all files from and then remove the DOSROOT directory:

```
DEL C:\DOSROOT\*.*
RD C:\DOSROOT
```

You should now be able to boot DOS from the hard disk and OS/2 from your Floppy Boot diskette.

STEP 7: FINAL ADJUSTMENTS When you boot OS/2 1.1 from the Floppy Boot diskette, you should keep the diskette in drive A: while OS/2 is running. Any OS/2 command-line session you start will use drive A: as the initial default drive and load OS2INIT.CMD (if it exists) from drive A:. Since this continual reference to the floppy disk would be a nuisance, it's fortunate that you can change it.

You first copy OS2INIT.CMD to a directory on the hard disk (C:\OS2, for example). In Start Programs, highlight "OS/2 full screen command prompt" line and select Change from the Program menu. In the Working Directory field change the simple backslash \ to C:\.

Similarly, if you created an OS2INIT.CMD file, in the Parameters field change

```
/K \OS2INIT.CMD
```

to the following:

```
/K C:\OS2\OS2INIT.CMD
```

Do the same for "OS/2 windowed command prompt". If you've also created a STARTUP.CMD file, change it to call OS2INIT.CMD and switch to drive C::

```
CALL C:\OS2\OS2INIT.CMD
C:
```

It should now be possible to remove the Floppy Boot diskette from drive A: after you boot OS/2.

MOVING THE OS2 DIRECTORY As an optional step, if you have multiple hard disks or partitions on your machine, you may want to move the whole C:\OS2 directory structure to another drive. You can do it, but there's some grunt work involved.

For purposes of illustration, I'll assume you want to keep all the OS/2 1.1 files on drive D:. Begin by creating a directory:

```
MD D:\OS2
```

AND THEN
NORTHGATE
CREATED...

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■ ENVIRONMENTS

and then you copy the files (including nested directories):

```
XCOPY C:\OS2\*.* D:\OS2 /S
```

You could also, of course, copy the files using the PM File System.

You must then change all the drive C: references in CONFIG.SYS, OS2IN-IT.CMD, STARTUP.CMD, and AU-TOEXEC.BAT to drive D:. On top of that, you must go through all the programs installed on Start Programs and change references from drive C: to drive D:. You should also run the Presentation Manager Control Program, select Spooler Options from the Setup menu, and change C:\SPOOL to D:\SPOOL.

Now boot OS/2 1.1 or DOS and delete the C:\SPOOL directory and everything in C:\OS2 and its nested subdirectories, and then remove the directories.

FILES YOU CAN DELETE   You can reduce some of the hard disk space consumed by OS/2 1.1 by deleting a few files.

You'll notice in the \OS2\DLL directory a DISPLAY.DLL. This is the graphics device driver for your video display. But this directory also contains IBMEGA .DLL (the EGA device driver), IBM-VGA.DLL (VGA), and IBMBGA.DLL (8514/A). Your DISPLAY.DLL is simply a copy of one of these files. You can delete the three IBM*x*GA.DLL files.

The \OS2 directory contains a number of mouse drivers, which have filenames of the form MOUSE*xxx*.SYS. You only need one—the one listed in your CON-FIG.SYS file in a DEVICE statement. You can delete the others. (If you don't have a mouse, you can delete them all.) Similarly, there are two serial port drivers, COM01.SYS (for the PC AT and the XT Model 286) and COM02.SYS (for the PS/2s). You can delete the one that's not for your system (or both if you have no serial port).

NOW FOR SOME PROGRAMS   Now that you have OS/2 1.1 (either booting from the hard disk or from a floppy diskette), you'll want some Presentation Manager programs. In the months ahead I'll present some here, and the .EXE files will be available for downloading from PC MagNet. PC

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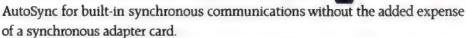
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■ **POWER PROGRAMMING** ■ RAY DUNCAN

UNDERSTANDING HASHING TECHNIQUES

Hashing techniques offer fast, near-constant-speed searching of appropriate data sets.
Here's an explanation of various hashing methods, with test-bed programs to explore them.

The subject of file management has provided an opportunity in the last few issues to look briefly at sequential searches, binary searches, indexes, and trees. It would be remiss of me to conclude this subject without considering another fundamental technique for addressing information: hashing.

Hashing is based on a concept quite different from the straight comparisons with keys we've been exploring. When we look up a record using a hashing scheme, we apply a transformation to the key to obtain a hash code that tells us where to find the record. In other words, we apply a hashing function to the key. This function maps all possible key values onto a (usually much smaller) set of possible record numbers.

Since it might not be immediately obvious how this differs from simply storing records in the order of their key values, let's follow the steps through a very simple example. Imagine a file containing five records, with the keys APPLE, BANANA, GRAPEFRUIT, KIWI, and LEMON, arranged as shown in Figure 1. Assume further that the hashing method we have chosen is to sum the ASCII codes for the letters in the key, then find the remainder of that sum divided by the number of records in the file.

Now let's see how this works if we want to fetch the record whose key is KIWI. We first sum the ASCII codes for the letters in the key (K = 4Bh, I = 49h taken twice, and W = 57h), yielding the value 134h (308). We next divide by the number of records in the file (5) and obtain the remainder 3. Finally, we multiply the

record size by 3 to obtain the byte offset of the record within the file, issue the appropriate operating system call to position the file pointer, and then read the record into memory.

So far, hashing seems pretty neat, right? No laborious comparisons, no flip-flopping back and forth in the file, no traversing of trees—just a simple computation on the key yields up the record position directly.

A DOSE OF REALITY Of course, if the real world were that simple, people wouldn't need programmers. The exquisitely simple hashing scheme I outlined above breaks down immediately for nearly every noncontrived collection of records and keys. In the first place, what happens when we add a new record to the file? The

Figure 1: *A data file in which each record's position corresponds to its key's hash code.*

Record	Main data file
0	APPLE
1	GRAPEFRUIT
2	BANANA
3	KIWI
4	LEMON
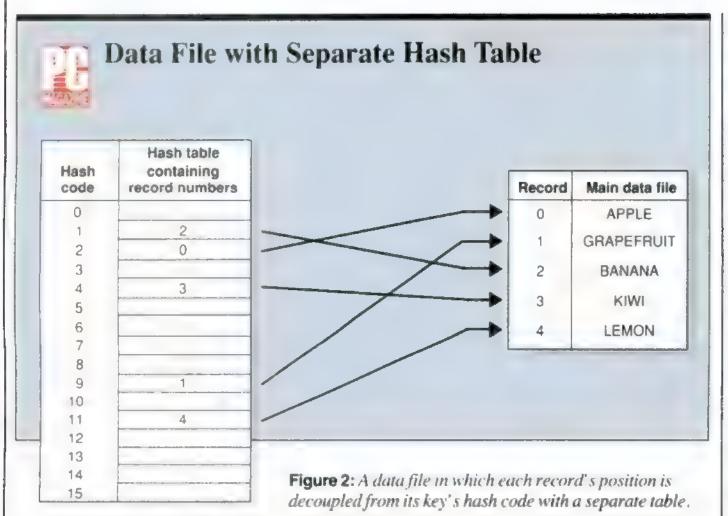
hash code for each record changes immediately, since it is a function both of the characters in the key and of the number of records in the file. Moreover, we might also need to move quite a few records around to insert the new record, and that's always undesirable.

More important still, we've made no provision at all for handling records whose different keys produce the same hash code. Such records are quite likely to occur, especially when the keys are English nouns (especially proper nouns); the distribution of letters in such words is far from random. Our primitive hashing technique does not even differentiate between keys that have the same letters in a different order!

These problems can be approached on many different levels. The first, which is almost invariably used, is to decouple the number of records in the file and their physical order from their hash codes. This is done by creating a separate hash table whose positions correspond to hash codes. Each slot in the hash table contains either a record number or a "magic value" that indicates that no record matching the hash code exists in the file. Such a decoupled scheme is shown in Figure 2. The hash table can be stored in a separate file (located at the head or tail of the data file) or, if the data file is not too large, it can even be built up on the fly by scanning the entire file each time it is opened.

The size of the hash table must be fixed when the file is created, and the number of possible entries in the hash table rather than the current number of records in the file becomes the divisor for the hash-code

■ POWER PROGRAMMING

Data File with Separate Hash Table

Figure 2: *A data file in which each record's position is decoupled from its key's hash code with a separate table.*

calculation. This allows the hash codes for a particular key to remain constant while the number of records in the data file changes. It turns out in practice that lightly loaded hash tables give the best results in terms of fast and near-constant search times, so the hash table should typically be several times larger than the maximum number of records the file is ever expected to contain.

Collisions—that is, records whose keys generate the same hash code (whether those keys are the same or different)—can be handled in two basic ways. The first method you can use is to chain all records with the same hash code together explicitly. In this case, when you probe the hash table and come up with a record number, you then read in the record and examine the actual key to make sure it is the same as the key you are looking for. If the keys match, you're done; otherwise you must inspect the linkage field to see if there are other records that have the same hash code. You then chase down the chain and inspect each additional record until you either find the one you need or establish that it is not present.

Explicit chaining is quite efficient from a searching standpoint, especially if collisions are so few that there are only a few short chains of records. This strategy does, however, have the disadvantage that it re-

quires allocating a link field in each record. If there are few collisions, most of the link fields are empty, which results in a lot of wasted space in the data file.

An alternative way to handle collisions is simply to generate another hash code from the same key and then reprobe until either an empty hash-table position is encountered or the desired record is found. This technique is called *open addressing*. A simple way to implement the open addressing method—called *linear probing*—is just to add a constant value to the hash code each time, "wrapping" the hash code when it exceeds the number of entries contained in the hash table. Linear probing works out quite well in practice, especially (once again) when the hash table is not heavily loaded.

Of course, when we use open addressing to resolve collisions, we want to guarantee that we will actually visit all the positions in the hash table before we give up. We can easily bring this about by making the number of entries in the hash table even and the incrementing value odd (preferably a prime). There is a variation of this technique called *double hashing*, in which the incrementing value is not a constant but is a function of the initially calculated hash code for the record key. Double hashing is widely used because it reduces clustering in the hash table.

GETTING THE BEST RESULTS The key to using hashing successfully is to know when to use and when to avoid it. Hashing is appropriate when the number of items in a file can be predicted fairly well in advance, so you can ensure that the hash table will not become filled up. In such situations, the very fast and near-constant search times that hashing can provide you are almost ideal. However, if there is a realistic danger that the hash table will become heavily loaded, you should instead consider using a binary-tree index, balanced tree index, or another similar approach.

The biggest drawback to hashing is that it does not offer any ordered view of your data. If you need to fetch records out of the file in the actual order of their keys, you'll have to either sort and rewrite the file (then regenerate the hash table) or build a separate sorted index.

Your hashing procedure must be written to be as efficient as possible, since it will be called by your program very frequently. You want to come up with a hashing scheme that will scatter the possible keys across your hash table as evenly as

> **■ Hashing is appropriate when the number of items in a file can be predicted fairly well in advance, so you can ensure that the hash table will not become filled up.**

possible, and will be capable of distinguishing between permutations of the same key elements (such as the two keys DOG and GOD).

In serious search applications with large data sets, you should write the hashing routine in assembly language so that you can shave every CPU cycle. You should stick to shifts, adds, ANDs, ORs, and XORs within the hashing calculation;

No matter which of these modes you use,

40-column CGA Text
40-column EGA Text
40-column VGA Text
80-column CGA Text
80-column EGA Text
80-column VGA Text
Lo-res CGA Graphics
Hi-res CGA Graphics
MDA Monochrome Text
80-column VGA Monochrome Text
Lo-res MCGA Graphics
Lo-res VGA Graphics
Med-res VGA Graphics
EGA Monochrome Graphics
Hi-res EGA Graphics
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avoid hardware multiplies and shun hardware divides at all costs. These last two are dreadfully expensive on the 8086/88 and can increase the execution time of your hashing procedure by an order of magnitude. Thus, for example, you should always make the size of the hash table a power of 2. You can then use the value one less than the size as an AND mask to find the modulus of the hash code.

If the data in your file is static, you may be able to tune the hashing algorithm to produce the least number of collisions for your particular data set. When the contents of the file cannot be known in advance, you might as well settle for a reasonable hashing algorithm and turn your attention to efficient handling of collisions. You can never be certain that the user isn't going to hand you a bizarre data set in which all the keys hash to the same value. If that happens, just make sure you can find all the records, even if the performance drops to dismal!

```c
/*
    MAKEHASH.C - Creates a data file and hash table for SRCHHASH.C

    Copyright (C) 1988 Ziff Communications Co.
    PC Magazine * Ray Duncan

    The user is prompted to enter from zero to one hundred ASCII
    strings.  These strings are used to build records in the
    main data file TESTFILE.DAT and a hash table TESTFILE.HSH.

    Each record in TESTFILE.DAT is RSIZE bytes long.  The size
    of the hash table is determined by the constant HASHSIZE.
    The incrementing value for linear probing is HASHINCR.
    All manifest constants and structures must be synchronized
    with SRCHHASH.C.
*/

#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <fcntl.h>
#include <sys\types.h>
#include <sys\stat.h>
#include <io.h>

#define ISIZE    80         /* max entry length */
#define N_ITEMS  100        /* max number of strings */
#define RSIZE    64         /* fixed record size */
#define HASHSIZE 1024       /* hash table size, should
                               be power of 2 */
#define HASHINCR 7          /* incrementing value for
                               linear probes of hash table */

char items[N_ITEMS * ISIZE];    /* original entries stored here */

int hashtab[HASHSIZE];          /* hash table built here */

int getkeys(void);              /* function prototypes */
void writedata(int);
void writehash(int);
int hashcode(char *);

main()
{
    int i;                      /* number of keys entered */

    i = getkeys();              /* get record keys from user */
    writedata(i);               /* write main data file */
    writehash(i);               /* write hash table */
}

/*
    Get record keys from user, leave them in array 'items',
    return number of keys to caller.
*/
int getkeys(void)
{
    int i, j;                   /* scratch variables */

    puts("\nEnter keys for file records...");

    i = 0;                      /* initialize string count */

    while(i < N_ITEMS)          /* enforce maximum entries */
    {
        printf("%2d: ", i+1);   /* prompt user for next string */
        gets(&items[ISIZE * i]);  /* read keyboard, store in array */

                                /* last entry if empty line */
        if(items[ISIZE * i] == 0) break;

        for(j = 0; j < i; j++)  /* make sure not duplicate key */
        {
            if(strcmp(&items[ISIZE * i], &items[ISIZE * j]) == 0)
                break;          /* exit loop if duplicate found */
        }

        if(i == j) i++;         /* count non-duplicate strings */
        else puts("Duplicate key, try again.");
    }

    return (i);                 /* return no. of keys entered */
}

/*
```

```c
    Create main data file TESTFILE.DAT, using strings stored
    in array 'items'.
*/
void writedata(recs)
{
    int i = 0;                  /* scratch variable */
    int fh;                     /* handle for output file */
    char recbuf[RSIZE];         /* scratch record buffer */

                                /* create main data file */
    fh = open("TESTFILE.DAT", O_WRONLY|O_CREAT|O_TRUNC|O_BINARY, S_IWRITE);

    if(fh == -1)                /* terminate if create failed */
    {
        puts("\nCan't create TESTFILE.DAT.");
        exit(1);
    }

    puts("\nWriting TESTFILE.DAT...");

    while(i < recs)             /* build and write records */
    {
        memset(recbuf, 0, RSIZE);
        strncpy(recbuf, &items[ISIZE * i], RSIZE);
        write(fh, recbuf, RSIZE);
        i++;
    }

    close(fh);                  /* release file handle */
}

/*
    Create hash table, using strings stored in the array 'items'.
    Write hash table into the file TESTFILE.HSH.
*/
void writehash(recs)
{
    int i = 0, j;               /* scratch variables */
    int fh;                     /* hash table file handle */

    memset(hashtab,-1,sizeof(hashtab)); /* initialize hash table */

    while(i < recs)             /* build hash table */
    {
        j = hashcode(&items[ISIZE*i]);  /* calculate hash code */
        hashtab[j] = i++;       /* put pointer into table */
    }

                                /* create hash table file */
    fh = open("TESTFILE.HSH", O_WRONLY|O_CREAT|O_TRUNC|O_BINARY, S_IWRITE);

    if(fh == -1)                /* terminate if create failed */
    {
        puts("\nCan't create TESTFILE.HSH.");
        exit(1);
    }

    puts("\nWriting TESTFILE.HSH..."); /* write hash table */
    write(fh, (char *) hashtab, sizeof(hashtab));
    close(fh);                  /* release file handle */
}

/*
    Calculate hash code from supplied ASCII string.  Probe hash
    table and increment hashcode if necessary in order to return
    the hashcode of an unused position in the hash table.  Hash
    code is clamped to the range (0 ... HASHSIZE-1).
*/
int hashcode(char *kptr)
{
    int i, j = 0;               /* scratch variables */

                                /* sum characters of key */
    for(i = 0; i < strlen(kptr); i++) j = (j*2) + kptr[i];
    j = j & (HASHSIZE - 1);     /* clamp hash code */

    while(hashtab[j] != -1)     /* search for unused slot */
    {
        j += HASHINCR;          /* increment hash code */

        if(j >= HASHSIZE)       /* wrap hashcode if necessary */
            j -= HASHSIZE;
    }

    return(j);                  /* return hash code */
}
```

Figure 3: *MAKEHASH.C is a test-bed program that creates a main data file and a hash table based on ASCII keys entered by the user. The resulting TESTFILE.DAT and TESTFILE.HSH files are used by the SRCHHASH program listed in Figure 4.*

■ POWER PROGRAMMING

```
/*
    SRCHHASH.C  Searches datafile and hash table created by MAKEHASH.C

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    The user is prompted to enter a search key.  A hash code
    is generated and is used to probe the hash table stored in
    the file TESTFILE.HSH.  The record number, if any, found
    in the hash table is used to read a record from TESTFILE.DAT.
    Collisions are resolved by adding a constant increment
    to the hashcode and wrapping when necessary until the
    desired record or an empty hash table position is found.

    Each record in TESTFILE.DAT is RSIZE bytes long.  The size
    of the hash table is determined by the constant HASHSIZE.
    The incrementing value for linear probing is HASHINCR.
    All manifest constants and structures must be synchronized
    with MAKEHASH.C.
*/

#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <fcntl.h>
#include <sys\types.h>
#include <sys\stat.h>
#include <io.h>

#define RSIZE    64              /* fixed record size */
#define HASHSIZE 1024            /* hash table size, should
                                   be power of 2 */

#define HASHINCR 7              /* incrementing value for
                                  linear probes of hash table */

int hashtab[HASHSIZE];          /* hash table read here */

int hashcode(char *);           /* function prototypes */

main()
{
    int i;                      /* scratch variable */
    int fhdf, fhht;             /* file handles */
    int inspected;              /* number of hash table
                                   entries inspected */
    long fsize;                 /* size of file in bytes */
    int frecs;                  /* number of records in file */
    char key[80];               /* key entered by user */
    char rec[RSIZE];            /* scratch record buffer */

                                /* open all files */
    fhdf = open("TESTFILE.DAT", O_RDONLY | O_BINARY);
    fhht = open("TESTFILE.HSH", O_RDONLY | O_BINARY);

    if((fhdf == -1) || (fhht == -1))
    {
        puts("\nMissing data file or hash table file.");
        exit(1);
    }

    fsize = lseek(fhdf, 0L, SEEK_END);   /* find file size */
    frecs = fsize / RSIZE;               /* calculate number of records */

    printf("\nTESTFILE.DAT contains %ld bytes, %d records.", fsize, frecs);

                                /* read hash table into memory */
    read(fhht, (char *) hashtab, sizeof(hashtab));
    close(fhht);                /* and release its handle */
    while(1)
    {
        printf("\n\nEnter key: ");      /* prompt user and */
        gets(key);                      /* input record key */

        if(key[0] == 0) break;          /* terminate if empty line */

        inspected = 1;                  /* initialize inspection count */
        i = hashcode(key);              /* calculate hash code */

        while(hashtab[i] != -1)         /* inspect datafile records */
        {
            lseek(fhdf, (long) (RSIZE * hashtab[i]), SEEK_SET);
            read(fhdf, rec, RSIZE);

            if(strcmp(rec, key) == 0)   /* if match, we're done */
                break;

            i += HASHINCR;              /* otherwise bump hashcode */

            if(i >= HASHSIZE)           /* wrap hashcode if necessary */
                i -= HASHSIZE;

            inspected++;                /* count table inspections */
        }

        if(hashtab[i] == -1) printf("\nRecord not found");
        else printf("\nContents of record %d: %s", hashtab[i], rec);
        printf(" --- %d hash table entries inspected", inspected);
    }

    close(fhdf);                        /* release data file handle */
}

/*
    Calculate hash code from supplied ASCII string.  Hash
    code is clamped to the range {0 ... HASHSIZE-1}.  Collisions
    are resolved elsewhere.
*/
int hashcode(char *kptr)
{
    int i, j = 0;                       /* scratch variables */

                                        /* sum characters of key */
    for(i = 0; i < strlen(kptr); i++) j = (j*2) + kptr[i];

    return(j & (HASHSIZE - 1));         /* clamp hash code */
}
```

Figure 4: *SRCHHASH.C opens the files created by MAKEHASH, prompts you for a key, and begins to search for it.*

HASHING TEST-BEDS The two programs that accompany this column, MAKEHASH.C shown in Figure 3 and SRCHHASH.C shown in Figure 4, are test-beds that will let you build small data files with a hash lookup table, and then search the file for a specific record. In the interest of clarity, no attempt has been made to optimize the hashing procedure for speed.

The first program, MAKEHASH.C, prompts you for up to 100 short ASCII strings, and when you press the Enter key alone in response to a prompt, it creates a main data file named TESTFILE.DAT, arranged in the order that you entered the strings. It then builds a hash-table, writes it into the file TESTFILE.HSH, and exits.

The second program, SRCHHASH.C (Figure 4), opens the TESTFILE.DAT file and the TESTFILE.HSH file, then prompts you for a key to search for.

SRCHHASH.C then reports whether the record exists and (if the record is present)

■ **MAKEHASH.C and SRCHHASH.C are test-beds that will let you build small data files with a hash lookup table, and then search the file for a specific record.**

---

how many hash-table entries and keys had to be inspected in order to find it.

The MAKEHASH.C and SRCHHASH.C programs can be used under either DOS or OS/2 without your having to make any changes to them. To compile the programs, enter the commands:

```
CL MAKEHASH.C
CL SRCHHASH.C
```

You can run MAKEHASH.EXE first to create a data file and hash table, and then run the SRCHHASH.EXE program to experiment with it. You can terminate SRCHHASH.EXE at any time by pressing Enter alone, Ctrl-C, or Ctrl-Break in response to a prompt.

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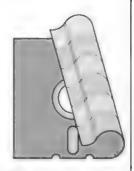
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■ **DOUGLAS COBB AND STEVEN COBB**

Spreadsheet Clinic

Discovering the timing assumptions that Framework and 1-2-3 use with the @NPV function; the different ways that 1-2-3's /xi and {If} commands handle the value ERR.

1-2-3's /xi and {If} commands handle the value ERR in different ways

The /xi and {If} commands each deal differently with conditional tests that return the value ERR. To the /xi command, the value ERR is true. Therefore, when the conditional test of a /xi command returns the value ERR, *1-2-3* executes the commands that follow on the same line as /xi. To the {If} command, on the other hand, the value ERR is false. So when the conditional test of an {If} command returns the value ERR, *1-2-3* skips the commands that follow on the same line as {If} and begins executing the commands on the next line of the macro.

The two macros in Figure 1 demonstrate this difference. The first, named \a, uses an {If} command to determine if the result of the formula ONE/TWO is greater than 100. The second macro, named \b, uses a /xi command to perform the same test.

The cell named ONE (B7) contains the value 1000, and the cell named TWO (B8) contains the value 0. Since division by 0 is undefined, the conditional tests of both commands return the value ERR. The {If} command in the first macro correctly interprets this result as false. It skips the {Down} and {Quit} commands that follow the {If} command in cell B1, and executes {Up} in cell B2 instead. This command causes 1-2-3 to move the cell pointer up one cell.

The /xi command in the second macro

incorrectly interprets the ERR result as true. Therefore, *1-2-3* executes the {Down} and {Quit} commands that follow /xi in cell B4. These commands cause *1-2-3* to move the cell pointer down one cell, then end the execution of the macro.—*Robert D. Kaiser; McLean, Virginia*

Fortunately, you can correct the erroneous action of the /xi command. To make /xi interpret the value ERR as false, as it should, use an @IF function as the conditional test of the /xi command as shown in Figure 2. The first argument of @IF should be an @ISERR function whose ar-

gument is the conditional test that you would use in an {If} command. The true result of the @IF function should be the value 0. The false result should be the same as the first argument, but without the @ISERR function. For example, to emulate the action of the {If} command in cell B1, you would replace the /xi command in cell B4 with

```
B4:  '/xi@IF(@ISERR(ONE/TWO>100),
       0,ONE/TWO>100)~{Down}{Quit}
```

If the inequality ONE/TWO>100 returns the value ERR, the @ISERR function will be true. Therefore, the @IF func-

	A	B	C	D	E
1	\a	{If ONE/TWO>100}{Down}{Quit}			
2		{Up}			
3					
4	\b	/xiONE/TWO>100~{Down}{Quit}			
5		{Up}			
6					
7	ONE	1000			
8	TWO	0			
9					
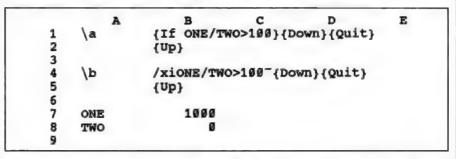
Figure 1: *Two macros that demonstrate how differently {If} and /xi interpret the value ERR. To the {If} command, the value ERR is true; to the /xi command, the value ERR is false.*

	A	B	C	D	E	F	G	H
1	\a	{If ONE/TWO>100}{Down}{Quit}						
2		{Up}						
3								
4	\b	/xi@IF(@ISERR(ONE/TWO>100),0,ONE/TWO>100)~{Down}{Quit}						
5		{Up}						
6								
7	ONE	1000						
8	TWO	0						
9								
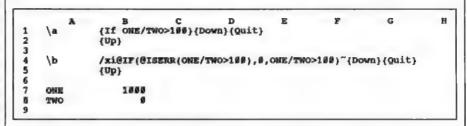
Figure 2: *Using the @IF function as the conditional test of the /xi command will make the /xi command interpret the value ERR as false, as it should.*

■ SPREADSHEET CLINIC

tion will return the value 0. Since /xi interprets the value 0 as false, it will skip the {Down} and {Quit} commands, and execute the {Up} command in cell B5 instead. If the inequality returns a value other than ERR, the @ISERR function will be false. Consequently, the @IF function will return the result of the inequality ONE/TWO>100—either true (1) or false (0). Depending on this result, *1-2-3* will execute either the commands {Down} and {Quit} in cell B4 or the command {Up} in cell B5.

An @NPV function uses different timing assumptions in *Framework* and *1-2-3*

I've discovered that *1-2-3* and *Framework* each use different default timing assumptions to evaluate an @NPV function.

1-2-3 assumes that each cash flow occurs at the end of a period; *Framework II* assumes that each cash flow occurs at the beginning of a period. This means that the same function returns a different value in *Framework* than it does in *1-2-3*.

To demonstrate this difference, let's suppose that cells A1..A5 contain the values -1000, 200, 300, 400, and 500, respectively. In *1-2-3* the function

`@NPV(0.1,A1..A5)`

would return the value 65.26. In *Framework II*, the same function (actually, @NPV(0.1,A1:A5) would return the value 71.78.

There is an easy way to adjust *Framework*'s @NPV function so it, too, assumes that each cash flow occurs at the end of a period. Insert the value 0 as an extra argument between the interest rate argument and the "range of cash flows" argument. In this case, for example, you would use the function

`@NPV(0.1,0,A1:A5)`

Assuming the cells A1:A5 contain the same values as before (-1000, 200, 300, 400, and 500, respectively), this function will return the value 65.26—the same result that the @NPV function returns in *1-2-3*.

Strangely, this mysterious "assumption-correcting" argument is not docu-

mented in any of the *Framework* manuals.—*Dan Arnett; Burlingame, California*

This is correct—adding an argument that consists of the value 0 between the interest rate argument and the "range of cash flows" argument makes *Framework*'s @NPV function return the same values as *1-2-3*'s. However, the use of this argument is neither mysterious nor undocumented.

Unlike *Lotus 1-2-3*, *Framework* allows you to list the cash flows for a net present value calculation in individual arguments directly within the @NPV function. For example, in *Framework* you could use the function

`@NPV(0.1,-1000,200,300,400,500)`

to calculate the net present value of an investment that involved a cash outlay of $1,000 today, a cash inflow of $200 one period from today, a cash inflow of $300 two periods from today, a cash inflow of $400 three periods from today, and a cash inflow of $500 four periods from today—which is exactly the same calculation performed by the function @NPV(0.1,A1:A5) if cells A1:A5 contain the values -1000, 200, 300, 400, and 500, respectively.

In light of this explanation, it is easy to see that the 0 in the function @NPV(0.1,0,A1:A5) simply represents the first cash flow. The insertion of this argument pushes each of the remaining cash flows one period into the future. Specifically, the function tells *Framework* that the cash outlay of $1,000 occurs at the beginning of the second period (the same as the end of the first period), the cash inflow of $200 occurs at the beginning of the third period (the same as the end of the second period), and so forth. Since this is the same assumption that *1-2-3* makes, the altered function returns the same value that the function @NPV(0.1,A1..A5) does in *1-2-3*.

If you wish, you can adjust *1-2-3*'s @NPV function to match *Framework*'s assumption of an up-front cash flow. Simply exclude the first cash flow from the @NPV function, then add that cash flow to the result of that function. For example, if each of the cash flows in cells A1..A5 of a *1-2-3* worksheet occurred at the begin-

ning of subsequent periods, you would use the function

`@NPV(0.1,A2..A5)+A1`

to calculate the net present value of those cash flows. If cells A1..A5 contained the values -1000, 200, 300, 400, and 500, respectively, this function would return the value 71.78—the same result that the function @NPV(0.1,A1:A5) returns in *Framework*.

Streamlining logical "or" conditional tests of @IF functions

A coworker who uses *Lotus 1-2-3*, Release 2.01, showed me a worksheet containing several @IF functions such as:

```
@IF(A1=243#OR#A1=234
#OR#A1=237#OR#A1=293
#OR#A1=296#OR#A1=298
#OR#A1=299#OR#A1=301
#OR#A1=313#ORA1=314,
"Match","No Match")
```

This function compares the value in a certain cell (A1) with a number of other values (243, 234, 237, 293, 296, 298, 299, 301, 313, and 314). If the specified cell contains any of these values, this function will return the string "Match". If it doesn't contain any of these values, this function will return the string "No Match".
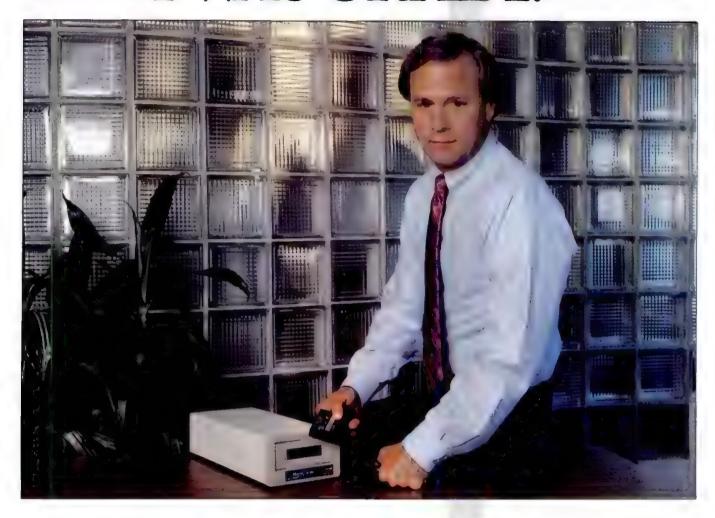
Although this function does what my coworker wanted, it is rather bulky and not very efficient. Testing each value requires the seven characters #, O, R, #, A, 1, and = in addition to the value itself. In light of *1-2-3*'s 240-character limit on cell entries, this extra baggage severely limits the number of values to which the function can compare the value in the specified cell.

After a bit of work, I found that *1-2-3*'s @FIND function provides a faster, more efficient way to test each value. First, I created a label consisting of all the values with which he wanted to compare the value in cell A1. I separated the values from one another by single spaces. Then I entered

```
'243 234 237 293 296 298
299 301 313 314
```

into an empty cell of his worksheet, cell A5. (Note the leading and trailing space in the label above.) The spaces in this label

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■ SPREADSHEET CLINIC

	A	B	C	D
1	177	No Match	234	
2			237	
3			243	
4			293	
5			296	
6			298	
7			299	
8			301	
9			313	
10			314	
11				

Figure 3: *The function in cell B1 of this worksheet determines if one of the values in cells C1..C10 matches the value in cell A1.*

assure that no "substring matches" will occur. Then I replaced his function with the function

```
@IF(@ISERR(@FIND(
" "&@STRING(A1,0)&" ",
$A$5,0)),"No Match","Match")
```

When *Lotus 1-2-3* evaluates this, it concatenates the string form of the value in cell A1 between two space characters. For example, if cell A1 contains the value 296, *1-2-3* returns the string " 296 ".

After calculating this result, *1-2-3* tries to find it within the label in cell A5. If the label contains these characters, the @FIND function will return a non-ERR value. In this case, the @ISERR function will be false, and *1-2-3* will return the string "Match". If the label does not contain an occurrence of these characters, the @FIND function will return the value ERR. In this case, the @ISERR function will be true, and *1-2-3* will return the string "No Match".

My function has several advantages over the #OR# technique: it is shorter for any list of more than three or four values; it remains the same length for any number of values; each value in the list carries only two characters of "baggage," compared with seven or more for the #OR# technique; and *1-2-3* is able to calculate it faster.—*Kevin Stevens; Richmond, California*

This clever use of the @FIND function is more efficient than stringing together multiple conditional tests with an #OR# operator. However, it's not without drawbacks. Since the "list" is in a single cell, it is difficult to update. The technique becomes more complex if different values have different numbers of digits to the right of the decimal point. And, even though this technique allows a bigger list

than the #OR# technique does, it still limits the list to 60 items or so.

The alternative technique shown in Figure 3 solves these problems. We entered each of the values in the list into individual cells of a single column (in this case, into cells C1..C10) in ascending numeric order. (You can use the /Data Sort command to put the list in this order, if you wish.) Cell A1 contains the value with which we want to compare the values in this list.

The function

```
B1:  @IF(@ISERR(@VLOOKUP(A1,
     $C$1..$C$10,0)),"No Match",
     @IF(@VLOOKUP(A1,$C$1..$C$10,0)=A1,
     "Match","No Match"))
```

in cell B1 determines if the value in cell A1 matches any of the values in this list. If the value in cell A1 is less than the first value in the list, the first @VLOOKUP function will return the value ERR. In this case, the @ISERR function will be true, and *1-2-3* will return the string "No Match".

If the conditional test of the first @IF function is false, indicating that the @VLOOKUP function returned a non-ERR result, then *1-2-3* will evaluate the second @IF function. The conditional test of this function determines whether the list contains an exact match for the value in cell A1. Since the @VLOOKUP function specifies an offset of 0, it returns a value from column C. If the list contains an exact match for the value in cell A1, the @VLOOKUP function will return this value. In this case, the conditional test will be true. Consequently, *1-2-3* will return the string "Match". If the list does not contain an exact match for the value in cell A1, the @VLOOKUP function will return the first value that exceeds that value. Here, the conditional test will be false, and *1-2-3* will return the string "No Match".

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■ NEIL J. RUBENKING

USER-TO-USER

DOS 4.0 adds EGA/VGA support to GRAPHICS.COM; deleting sensitive files in DEBUG; preventing accidental formatting of disks with data you want to keep.

Here's a batch file that checks a disk for data before formatting

I like to check a disk for data before I format it. And I find that using FORMAT .BAT instead of FORMAT.COM is a safe way to ensure that I don't format floppies that contain data I want to keep.

Before using FORMAT.BAT (Figure 1) you must rename FORMAT.COM. I've chosen a name that is difficult to remember—X123LUL0.COM—so there's no chance I might use the file unintentionally. This batch file first attempts to display a directory of the disk to be formatted. If the disk does contain data, FORMAT .BAT will instruct you to press Ctrl-C at the end of the directory display. Next, when it asks if you want to terminate the batch file, enter Y.

If the disk to be formatted is blank, however, the old familiar Abort, Retry, Ignore? prompt appears. Select the Abort option by typing A, and FORMAT.BAT will begin formatting the disk by running X123LUL0.COM, the renamed version of the original FORMAT.COM that came with your system.

After formatting is complete, you could format more disks by answering the Format Another Disk? prompt affirmatively. An affirmative answer restarts X123LUL0 .COM, however, not FORMAT.BAT. It will not attempt to display a directory. The correct answer to the Format Another Disk? prompt is "no." Enter N and FORMAT.BAT will proceed to run LABEL .COM, allowing you to label the newly

formatted disk, and then will terminate.

Note that to create a formatted disk with DOS on it, you'll have to modify FORMAT.BAT. Change line 16 from X123LUL0 %1 to X123LUL0 %1/S. You may want to save this modified version under another name, such as SFORMAT .BAT.

And last but not least, remember to put FORMAT.BAT in a directory on your system path where DOS can find it.—*S. R. Perry; Vallejo, California*

I added a check to FORMAT.BAT to make sure that I use it only on drives A: and B:. You don't want to format your hard disk accidentally, so it should be difficult to do. Be sure to answer "no" to the Format Another Disk question; the point of FORMAT.BAT is lost if you don't.

Of course, you may *want* to format a disk even if it does have data on it, but at least you'll see a directory of what's there before you wipe it out.

Supercharging the DOS SHIFT command

Do you know the real power of the SHIFT command? In User-to-User, September 13, 1988, Peter A. Klein gave us TO .BAT, a utility that accepts directory names separated by spaces rather than backslashes and thereby makes changing directories faster. You may remember, too, the MULTIDEL.BAT utility. Both were based on the FOR command but were restricted by a limited number of arguments (%1 to %9). Well, the SHIFT command can solve this limitation. Figure 2 shows a modified MULTIDEL.BAT that takes twice as many arguments.—*Cyril Pagniez; Anzin, France*

The DOS batch file processor reads one line at a time from the batch file. Hence, there's virtue in minimizing the number of batch lines you use to accomplish a given

```
ECHO OFF
FOR %%v IN (a: b: A: B:) DO IF %1==%%v GOTO OK
ECHO You can only format drives A: and B: with this batch file.
GOTO End
:Ok
ECHO If you get an "Abort, Retry, Ignore" message, the disk is
ECHO not already formatted.  Select A for Abort and continue.
DIR %1
ECHO If a directory appeared press CTRL-C now.
PAUSE
REM Assumes FORMAT.COM has been renamed "X123LUL0.COM".
X123LUL0.COM %1
LABEL %1
:End
```

Figure 1: *Rename FORMAT.COM and use this batch file to prevent accidentally formatting disks with valuable data that you want to keep.*

■ USER-TO-USER

```
REM SUPRSHFT.BAT Deletes MANY multiple files
ECHO OFF
:Again
FOR %%f IN (%1 %2 %3 %4 %5 %6 %7 %8 %9) DO DEL %%f
FOR %%x IN (1 2 3 4 5 6 7 8 9) DO shift
IF NOT "%1"=="" GOTO Again
```

Figure 2: *Supercharge SHIFT by using FOR to make many shifts with a single line.*

task. Rather than repeat SHIFT for every command-line argument, the modified MULTIDEL.BAT uses FOR to perform nine shifts with a single line. That brings in nine new arguments.

Mr. Pagniez said that his MULTIDEL .BAT takes twice as many arguments. With the loop I added, it actually takes as many arguments as you can fit on the command line. And it processes them nine at a time, a real feat for a batch file.

How to completely delete sensitive files using DEBUG

I enjoyed your column on DEBUG in the November 15, 1988, issue. However, you did not cover how to truly remove sensitive data using DEBUG. I find that the best way is as follows. [Note: *Don't* try this. It is a good idea, but it is not correct. See the reply below for a safe method.—*Ed.*]

```
DEBUG MYFILE.DAT
-F 100 FFFF 'All Junk'
-W
-Q
DEL MYFILE.DAT
```

or, for long files:

```
DEBUG MYFILE.DAT
-F 1000:100 FFFF 'All Junk'
-F 2000:100 FFFF 'All Junk'
-F 3000:100 FFFF 'All Junk'
```

—*James D. Rylander; Americus, Georgia*

This is a good idea, but the execution isn't quite correct. In fact, there's really no telling what the F 1000:100 series will do. It could very well overwrite the DEBUG program or COMMAND.COM in memory, with unpredictable results.

How can you *safely* use DEBUG to wipe out a sensitive file's data? First, remember to experiment with a file you can afford to lose. Make a copy of one of your files, or choose one that you don't care about. Second, you need to know that

when DEBUG loads a file, it records the file's size in registers BX and CX. The actual size in bytes is BX * 65,536 + CX. If the file is smaller than 64K, as is often the case, BX will be zero. You must then load the file into DEBUG, fill its memory image with nonsense, and write the file back to disk.

There are two ways you can use DEBUG to fill (the F command) a file's memory image with a nonsense string. You can fill from a starting address to an ending address, as shown below:

```
F CS:100 FFFF 'Nonsense'
```

This fills bytes from the address CS:100 to the address CS:FFFF with the nonsense string. Or you can fill from a starting address for a given number of bytes:

```
F CS:100 L FF00 'Nonsense'
```

This fills in FF00 bytes starting at CS:100. There is a limitation here, however: the offset plus the number of bytes must be less than 64K.
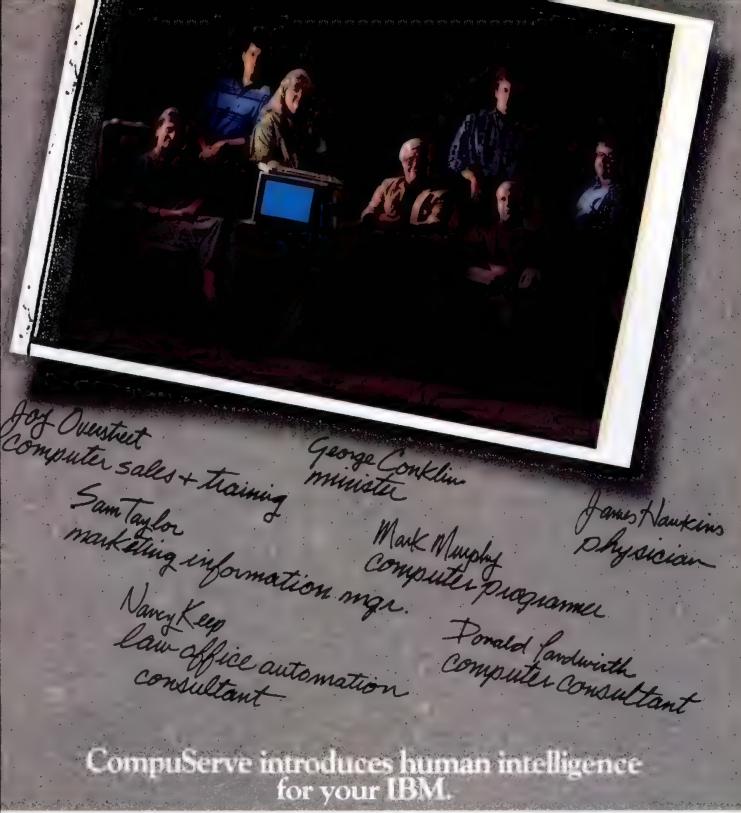
Next, load the file into DEBUG with the command

```
DEBUG FILENAME.EXT
```

You'll get a hyphen (-) prompt. Press R and hit Enter. The R command displays the Registers. Make a note of the values of CX, BX, and CS.

If your file is smaller than 64K, BX will be 0 and you will need only one fill command. First, calculate the proper segment address to use. DEBUG always loads a file at offset 100h; you need to calculate the segment value that will let you start filling at offset 0. (You can use this method even if you don't understand the details.) The value you need is the initial value of CS plus 10h. If you know hexadecimal arithmetic, just add it in your head. Otherwise, give the command

```
H xxxx 10
```

Joy Overstreet
computer sales + training

George Conklin
minister

Sam Taylor
marketing information mgr.

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■ USER-TO-USER

where xxxx is the CS value you noted above. The result will be two numbers; note the first as your starting segment. To fill the file with a nonsense string, use

```
F ssss:0 L zzzz 'Nonsense'
```

where ssss is the starting segment and zzzz is the original value of CX. You're finished. Enter W to write the changed data and then Q to quit DEBUG.

If the file is bigger than 64K, you have more work to do. Fill as many complete 64K segments as the number in the BX register, then finish by filling any remaining bytes. Start as before, by calculating the starting segment. Repeat this command as many times as the value of BX:

```
F ssss:0 FFFF 'Nonsense'
```

In this command ssss represents the starting segment. After each time you give the command, add 1000h to the starting segment. You can use the H command to do so, but it's easiest just to increase the segment's first digit by one.

To fill the final partial segment, do exactly as you would if the file were less than 64K, but use the starting segment calculated after the last full-segment fill-in. That will be

```
F ssss:0 L CX 'Nonsense'
```

Type W to write the changed data and Q to quit DEBUG.

Now your file's sensitive data has been overwritten by whatever nonsense string you chose. The data is gone, and nobody can retrieve it no matter what they do.

Take advantage of the EGA/VGA support DOS 4.0 adds to GRAPHICS.COM

If you've recently bought DOS 4.0 but have returned to an earlier version to wait for fixes, you're foregoing one of the upgrades. IBM has added EGA and VGA support to the GRAPHICS.COM program. Since this program, like most other DOS utilities, checks the DOS version number before executing, you will lose this added benefit if you return to an earlier version of DOS.
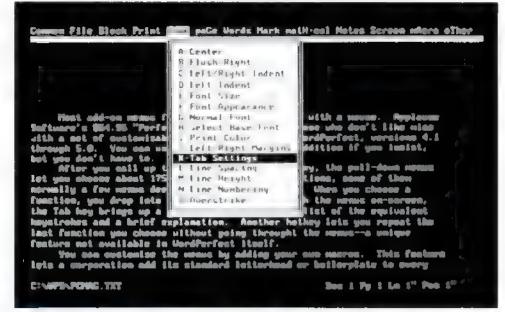
I found a way around this by first locating the section of code that checks for the DOS version, and then entering NOPs (HEX 90s) into the location that is jumped over if DOS 4.0 is not being used. Before you try this, make a copy of your DOS 4.0 version of GRAPHICS.COM and rename it; I called mine GRAPH4.COM. Then run DEBUG GRAPH4.COM and enter U 175F at the prompt. You will see something like the listing in Figure 3. (I have added the comments to the right of the listing.) As usual, ignore the values indicated by Xs, since they will vary from system to system.

■ USER-TO-USER

To "NOP out" the JNZ instruction, enter this command at the DEBUG hyphen prompt:

```
-E 1766 90 90
```

Enter W to write the changed file to disk and Q to quit DEBUG.

If you are going to keep the new name, you will have to rename the GRAPHICS.PRO file GRAPH4.PRO. Now enter GRAPH4, display an EGA or VGA picture, and hit PrtSc. It should work no matter what DOS version you are using.—*Dave Roznar; Saratoga, California*

A NOP command tells the computer to do nothing; it means No-OPeration. The easiest way to remove instructions from a program with DEBUG is to replace them with NOPs. In this case, we've eliminated the command that causes GRAPHICS.COM to halt if the program detects the wrong DOS version.

It's amazing what the old dot matrix printer can do. The quality of the pictures is surprisingly good. Each of the 16 palette colors gets replaced by a different fill pattern. To get light colors mapped to light patterns and dark colors to dark patterns, invoke GRAPH4 with the /R command-line parameter. If you happen to omit the /R, you may find that white clouds print as black.

To use GRAPHICS.COM, you *must* have a printer that emulates the control codes for an IBM graphics printer. If earlier versions of GRAPHICS.COM work on your printer, DOS 4.0 probably will too.

You can hide batch file actions and still interact with users when necessary

According to the November 10, 1987, Help File, the CTTY command will change standard I/O. I can redirect standard I/O to AUX, COM1, COM2, COM3, COM4, and CON (to restore to screen and keyboard). So I decide to try this: nothing's better than a good test in the field. I get back to my keyboard and type CTTY NUL (I couldn't find any better device for this test). What a surprise: my computer isn't responding anymore! I have to hit my ON/OFF switch to bring my computer back into the real world.

I try again. I use CTTY NUL in a batch file, and I use CTTY again with the CON parameter. It works! This lets me prevent any output from being displayed on the screen in the middle of a batch file. What about echoing a message on the screen? I usually use the ECHO command in a batch file to output a message to the screen. This will certainly work, too, although since I've redirected the output to the NUL device by the CTTY command, I have to force the output by adding > CON after the ECHO command.

It's also possible to read from the keyboard, even if the input device is changed to NUL, by forcing the use of the console as the input device. Using, for example, PAUSE < CON forces that input to come from the console. The batch file in Figure 4 is a brief example.—*Christian Vézina; Sherbrooke, Quebec, Canada*

```
-u 175f

xxxx:175F B430      MOV   AH,30    <-- RETURNS DOS VERSION
xxxx:1761 CD21      INT   21       <-- WHEN THIS IS EXECUTED
xxxx:1763 3D0400    CMP   AX,0004  <-- COMPARE FOR DOS 4.00
xxxx:1766 7503      JNZ   176B     <-- THIS IS THE INSTRUCTION TO NOP
```

Figure 3: *Carefully compare your screen to these lines to make sure you're patching the right section of code in DOS 4.0's GRAPHICS.COM program.*

```
CTTY NUL
ECHO You will not see this line.
ECHO You will see this line, but not the line before. > CON
ECHO Now press a key -- input to PAUSE comes from CON. > CON
PAUSE < CON
CTTY CON
```

Figure 4: *Even when you've used CTTY NUL, you can redirect I/O for individual batch lines.*

This is a new twist on an old trick. By redirecting certain batch lines back to CON, you can communicate with the user through a series of batch lines that are hidden by a CTTY NUL. Of course, you could put CTTY CON before a line and

■ A NOP command tells the computer to do nothing; it means No-OPeration.

CTTY NUL after, but the fewer lines a batch file has the better.

I immediately thought of one problem. What if I press Ctrl-Break in response to PAUSE < CON? Will I terminate the batch file before the line with CTTY CON, leaving myself out of touch with the computer? Fortunately, this doesn't happen.

Productivity Tip

A long path statement can slow down your work, since DOS sometimes has to search every directory on the path. If you keep the data files for each program in a subdirectory of the program itself, you can shorten your path quite a bit. Just use two periods (..) in the path. For example,

```
PATH ..;C:\DOS;C:\UTILS
```

Now whenever DOS is searching for a program, the first place it will look is in the parent of the current directory.

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POWER USER

Automatically perform your choice of WordPerfect macro commands on a group of files; generating different versions of exams is simple with WordPerfect's merge features.

WordPerfect's merge feature makes it easy to generate multiversion exams

The merge feature of many word processors can simplify the job of generating multiple versions of an exam by letting you change the order of questions and answers and print the exams in any format you like. I'll use *WordPerfect* 5.0 to illustrate the process.

First, type the questions and answers in the format of the word processor's secondary merge file. Each question as a whole thus becomes a record, and each part of the question is a field. In a multiple-choice exam, for instance, the body of the question is one field and each answer choice is a separate field. Another field could indicate the correct choice, and still other fields might contain information on subject matter, source, difficulty level, and so forth.

In *WordPerfect* secondary merge files, each field ends with a Merge R, which is entered by pressing F9. Each record ends with a Merge E, Shift-F9. When the file is ready, give it a name that identifies it as a secondary merge file—for example, EXAM.2ND—and save it on a disk. If you wish, you can scramble the questions by sorting the file with your choice of field and word as key. Save each version with a different name.

Now clear your screen so you can make the primary merge file that will format the exam. The questions will be numbered automatically by the paragraph-numbering feature. The way you arrange the fields in

this file determines how the questions will appear on the exam form.

A typical primary file for an exam would be entered with the keystrokes shown in Figure 1. When you're done, go back to the beginning of the question before the margin release and block the entire entry. Turn on the block protect feature <Shift-F8>y to prevent questions from being split at page breaks. Finally, end with ^N^P^P to keep *WordPerfect* from putting a page break after each question. You enter ^N and ^P by holding Ctrl and pressing N and P, respectively.

You can scramble the answer order by arranging the answer fields in a different order. Give each scrambled primary merge file a unique name and save it on your disk. Make a key primary file for each version by adding the answer field.

When the primary merge files are saved, clear the screen and prepare an exam header file. Include page number-

ing, special instructions, headers or footers, and so on. If you're using auto-numbering, define the numbering system you want. Save the header with a unique name so you can use it again.

With the cursor where you want the questions to begin after the header, start the merge process with <Ctrl-F9>1. Type the names of your primary and secondary merge files when the program asks for them, press Enter, and after a brief pause your exam questions will appear. To get other formats, format the primary merge file the way you want it to print.

Management of large question banks is easier if you use the Notebook program in *WordPerfect Library* or WordPerfect Corp.'s new database program called *DataPerfect*. Any database that lets you generate secondary merge files with the right format for your word processor will work as well.—*Frank T. Awbrey; San Diego, California*

```
<Shift-Tab>            ;releases the left margin.
                       ;answer space.
<Shift-F5>51<CR>       ;Paragraph number.
<F4>                   ;indent.
<Shift-F9>f1<CR>       ;<Shift-F9> shows the merge codes
                          f1 selects field 1, the body of
                          the question.
<Tab>a)                ;a Tab character and "a)"
<Home><Space>          ;a hard space after the right
                          parenthesis keeps the letter on
                          the same line as its text.
<Shift-F9>f2<CR>       ;field 2, first answer choice.

...repeat from <Tab> for other answers.
```

Figure 1: *How to create the primary merge file for a multiversion test in* WordPerfect.

■ POWER USER

A copy of last year's exam won't be worth much if you use this method to scramble the information. When you sort the questions on a randomly chosen word of a randomly chosen field, even *you* won't know what their order will be! But you'll have no trouble grading the exam—just make a copy of your primary file and add the answer field to it, perhaps in boldface or underlined. Merge and print, and you'll have a copy of the exam—with answers.

Just in case you're not familiar with sorting merge files, here's how to do it: Hit <Ctrl-F9>S for Sort and press Enter twice. Press T for Type and M for Merge Sort. Now press K for Keys and choose your key word. You'll almost certainly want the sort to be alphabetic, so put an "a" under Type. Choose one of your merge fields and enter its number under Field. Skip a line and enter your chosen word number under Word. Press F7 (Exit) to stop entering fields, then P to Perform the sort. That does it! As the text suggests, save the sorted exam file under a different name.—*Neil J. Rubenking*

You can perform the *WordPerfect* macro commands of your choice on a group of files automatically

One feature that, as a technical writer, I wish *WordPerfect* 5.0 provided is the ability to process a batch of files automatical-

ly. If I'm writing a ten-chapter manual describing the use of the Model XYZ printer and find that the model number has been changed to ABC, all ten chapters need the same correction: replace all occurrences of XYZ with ABC and resave the chapter.

Updating the chapters—one file at a time—is as simple as doing a search and replace. But how can you conveniently modify the files as a group? Here's a pair of macros that do the trick.

■ GLOBAL.WPM is a generic macro that finds a file with a specified extension within a directory, modifies it, and changes its extension to .TMP (for TeMPorary). Figure 2 shows what this macro looks like when examined with *WordPerfect*'s macro editor. I refer to this macro as "generic" because it provides only the framework for automatically modifying multiple files. You must edit the area denoted as "<actions>" (including removing the brackets) to indicate the actions to be taken.

■ RENAME.WPM is a macro that finds a file with a .TMP extension within a directory and changes its extension. The "rename" macro looks like Figure 3.

Assume that the files for all ten chapters have a .TXT extension and are in a single directory. Since the "global" macro is generic (and reusable), I edit a *copy* of it to perform the search-and-replace operation. Continuing with the example above, the modified GLOBAL2 macro now looks like Figure 4. Notice that "<actions>"

```
{DISPLAY OFF}{List Files}{Home}{Right}{Backspace}txt{Enter}
{;}The·line·above·gets·a·display·of·all·*.TXT·files¬
{Down}1{;}Retrieve·the·first·*.TXT·file¬
{List Files}{Home}{Right}{Backspace}txt{Enter}{Down}2y
{;}The·line·above·deletes·the·*.TXT·file·you·just·retrieved¬
{Cancel}{;}Now·leave·the·List·Files·screen.¬
<actions>{;}Put·actions·to·perform·on·each·file·HERE.¬
{Save}{Home}{Right}
{Backspace}{Backspace}{Backspace}tmp{Enter}
{;}The·line·above·renames·the·file·to·*.TMP¬
{Exit}nn{;}Clear·the·document·w/o·leaving·WordPerfect¬
```

Figure 2: *A template for a* WordPerfect *5.0 macro that performs specified actions on .TXT files.*

```
{DISPLAY OFF}{List Files}{Home}{Right}{Backspace}tmp{Enter}
{;}The·line·above·gets·a·list·of·all·*.TMP·files.¬
{Down}3{Home}{Right}{;}Rename·this·file¬
{Backspace}{Backspace}{Backspace}txt{Enter}
{;}Change·its·extension·to·TXT¬
{Exit}
```

Figure 3: *This macro renames every .TMP file with a .TXT extension again.*

■ **POWER USER**

```
{DISPLAY OFF}{List Files}{Home}{Right}
{Backspace}txt{Enter}
{;}The·line·above·gets·a·display·of~
{;}all·*.TXT·files~
{Down}1{;}Retrieve·the·first·*.TXT·file~
{List Files}{Home}{Right}{Backspace}txt
{Enter}{Down}2y
{;}The·line·above·deletes·the·*.TXT·file~
{;}you·just·retrieved~
{Cancel}{;}Now·leave·the·List·Files·screen~
{;}···········ACTIONS···········~
{Home}{Home}{Home}{Up}{Replace}nXYZ
{Search}ABC{Search}
{;}··········ACTIONS···········~
{Save}{Home}{Right}
{Backspace}{Backspace}{Backspace}tmp{Enter}
{;}The·line·above·renames·the·file·to·*.TMP~
{Exit}nn{;}Clear·the·document·w/o·leaving~
{;}WordPerfect~
```

Figure 4: *This is a specific example of the general macro shown in Figure 2.*

has been replaced with the actual keystrokes required to replace all occurrences of XYZ with ABC.

To use the macros, begin by pressing the Esc key. The screen will display "n = 8". Type the number of times you want the macro to execute (10, in this case), but do *not* hit Enter. Press Alt-F10 instead. "Macro:" appears on the screen. Type GLOBAL2 and press Enter. "* Please wait *" appears and the screen goes blank until the macro finishes. Examining the directory shows that all the .TXT files now have a .TMP extension. They have been modified by the search-and-replace operation and temporarily renamed.

Now repeat exactly the same steps listed above down to the point where "Macro:" appears on the screen. This time, type RENAME and press Enter. Again, the wait message appears and the screen is blanked while the macro executes. Afterwards, examining the directory will show that all the files have been renamed with their original .TXT extension. You can modify both macros to work with whatever file-naming convention you wish to use. —*Frank L. Calloway; Loveland, Colorado*

In the example of a ten-chapter book, an alternative solution would be to use *Word-Perfect* 5.0's Master Document feature. In the master document, you would insert codes for each subdocument, using <AltF5>2. You'd also want to insert codes for the table of contents, index, and so forth in the master document. Then, to make a change in all of the subdocuments, you would expand the master, make the change, and condense the master.

Still, Calloway's GLOBAL and RENAME accomplish the same thing without requiring you to create a master document. It would be nice if you could make them into looping macros that would automatically stop when they had found all the matching files. Unfortunately, the {ON NOT FOUND} macro command has no connection with the List Files function. You really do have to *count* the files you want to process and use the Esc "Repeat Value=" method to run the macro the right number of times.—*Neil J. Rubenking*

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LANGUAGES

BASIC's WINDOW command displays characters upside down; CHAINing compiled Turbo Basic programs makes them smaller; recovering Turbo Basic's full-screen display speed.

A better approach to rounding numbers in BASIC

A rounding function should work with numbers of any magnitude, and values such as 7.654321E−30, 7.654321E+30, and 7654321 should all be handled with equal facility. The QuickBASIC 4.0 function ROUNDOFF.BAS, shown in Figure 1, does just this.

Besides rounding a number to a sensible number of figures, this function is useful in logical comparisons. Programmers know that comparisons of real numbers can produce unpredictable results. For example, IF X = Y THEN . . . may fail because of the way the numbers are represented internally in the PC, even when for all practical purposes they are the same. Using a comparison such as IF Round-Off!(X!, 6) = RoundOff!(Y!, 6) THEN . . . avoids this difficulty.—*Joseph H. Noggle; Wilmington, Delaware*

Unlike the other rounding functions we have printed, RoundOff!() deals with an entire number, not just the digits after the decimal point. Thus, RoundOff!(12345 !, 3) will produce the result 12300, and RoundOff!(12345!, 2) will yield 12000.—*Ethan Winer*

Making compiled Turbo Basic programs smaller

I was surprised to find that no matter how small a source program I begin with, Tur-

bo Basic creates a final .EXE file that is at least 25K bytes long. However, if I use the CHAIN option when compiling, the resulting program will be considerably smaller.

The program shown in Figure 2, LOADER.BAS, will load and execute any Turbo Basic CHAIN program. To use it, simply enter LOADER *<program>*, where *<program>* is the name of the CHAIN file to run. If the program name is omitted, LOADER will display a list of the files in the current directory and allow you to enter the desired name.—*Steven Marcotte; Belton, Missouri*

When Turbo Basic creates a standalone program, a large portion of the runtime library is always added to the .EXE file. This includes support for string manipulation, printing, and input commands, in addition to the other essential routines needed by most programs. But when a program is chained, those routines are already in memory and do not need to be duplicated in the disk file.

This is a useful trick for QuickBASIC programmers too, though in that case the CHAIN command should be used instead of RUN. Also, the programs must be compiled without the /O option.—*Ethan Winer*

```
FUNCTION RoundOff! (X!, K%) STATIC
    IF K% > 6 THEN K% = 6
    IF ABS(X!) > 1E-39 THEN
        NP% = K% - 1 - INT(LOG(ABS(X!)) / LOG(10#))
        PN# = 10# ^ CDBL(NP%)
        L& = PN# * X!
        RoundOff! = L& / PN#
    ELSE
        RoundOff! = 0
    END IF
END FUNCTION
```

Figure 1: *A QuickBASIC 4.0 function to round a value to any number of significant digits.*

```
10 CLS: PRINT "LOADER V2.0"
20 F$ = COMMAND$: IF LEN(F$) GOTO 50
30 FILES "*.TBC": PRINT
40 INPUT "Enter the program to run: ", F$
50 CLS: PRINT "Running: " F$
60 RUN F$ + ".TBC"
```

Figure 2: *LOADER.BAS runs Turbo Basic CHAIN files to save disk space.*

■ LANGUAGES

Restore Turbo Basic's full-screen display speed in the editing environment

One of the advantages of Turbo Basic is its fast screen updating. Unfortunately, the improved display speed is only for pro-

> ■ Adding SHELL "CLS" to a Turbo Basic program lets you print quickly in the editor.

grams that have been compiled to an .EXE file. Consequently, in the Turbo Basic editor, printing is noticeably slower. By sim-

```
'Run this program with and without the
'following line to see the difference
SHELL "CLS"

CLS
DIM Array$(72)
FOR X = 1 TO 72
   Array$(X) = STRING$(79, X + 32)
NEXT
FOR X = 1 TO 72
   PRINT Array$(X);
NEXT
```

Figure 3: *FAST.BAS demonstrates a technique for printing quickly in the Turbo Basic editing environment. Be sure to remove the SHELL statement before creating the executable program.*

ply adding the statement SHELL "CLS" to a Turbo Basic program, you can make it print as quickly in the editing environment as it would as a standalone program. This is demonstrated in the program FAST .BAS in Figure 3. If you use this tech-

nique, be sure to remove the SHELL statement before creating a final executable program. You have to take this additional step because the display speed is affected only in the editing environment.—*William Loud; Emmett, Idaho*

■ LANGUAGES

This tip works as advertised and indeed restores the full display speed that Turbo Basic provides in a standalone program. The reason it works is that Turbo Basic usually does its printing through a "window manager" that also handles the editor and trace windows. When a SHELL statement is executed, Turbo Basic must relinquish the entire screen to DOS, thus disabling the window manager.—*Ethan Winer*

This BASIC program allows you to choose from 16 colors in CGA hi-res graphics mode

For years I had accepted that attempting to specify a color in the CGA high-resolution graphics mode would cause an error. I was recently pleased to discover a way to dis-

■ COLORS.BAS is a simple and effective way to dress up a program's output when an EGA display is not available.

play any of the 16 possible colors by using a simple OUT statement in BASIC. The short program COLORS.BAS in Figure 4 illustrates this technique.—*Ben Crocker; Pasadena, California*

This program lets you pick from a range of colors, but only one color can be active

at a time. Still, this is a simple and effective way to dress up a program's output when an EGA display is not available. Because a hardware port is being accessed directly, this method should be used only if you are sure that a CGA display adapter is installed.—*Ethan Winer*

The simple power of the BASIC WINDOW command lets you display characters upside down

BASIC's WINDOW command packs a lot of power into a single instruction. Besides letting you specify new screen coordinates, it can also be used to reverse the screen. The program INVERT.BAS in Figure 5 prints a test message, captures it

```
10 DIM Message(77)
20 SCREEN 1, 0
30 CLS
40 LOCATE 12, 15
50 PRINT "PC Magazine"
60 GET (80, 88)-(231, 95), Message
70 WINDOW (0, 0)-(319, 199)
80 PUT (80, 95), Message
```

Figure 5: *BASIC's WINDOW command makes it easy to reverse the screen.*

in an array using GET, reverses the screen, and then displays the message upside down using PUT.—*Michael Trombetta; Manhasset, New York*

C and Pascal programmers take note: WINDOW is one of BASIC's most powerful graphics commands. It is normally used to eliminate the need to count pixels when calculating where to put things on the screen. WINDOW is especially useful when the same graphics images must be drawn on a variety of monitors. For exam-

```
CLS
FOR Z = 0 TO 7
    LOCATE 5+Z, 10: COLOR Z, 0: PRINT Z; STRING$(25, 219);
    COLOR 7, 0: PRINT TAB(45);: COLOR Z+8: PRINT USING "##"; Z+8;
    PRINT " "; STRING$(25, 219)
NEXT
COLOR 7,0: PRINT: PRINT TAB(15);
INPUT "Enter your choice of color for chart and lettering: ",CLR1
SCREEN 2, 1: OUT 985, (CLR1 - (CLR1 = 0)): CLS
LINE (0, 0)-(639, 199)
X$ = INPUT$(1): SCREEN 0
```

Figure 4: *Use the COLORS.BAS program to select any of the 16 available colors in the high-resolution CGA graphics mode.*

■ LANGUAGES

ple, to center a small box on the screen in CGA SCREEN 1, the image would be centered at location 160,100. But for an EGA in high-resolution SCREEN 9, the center is instead located at 320,175. The

■ BASIC's WINDOW command lets you define your computer screen using any coordinates you like.

problem gets worse when all of the other possible screen modes and resolutions must be considered. WINDOW lets you instead define the screen using any coordinates you like.—*Ethan Winer*

Productivity Tip

One of the neatest features of Quick-BASIC 4.0 is the new fixed-length string variable type. Unfortunately, Microsoft failed to show how to pass an array of them to a function or subprogram. Simply define a TYPE with just a fixed-length portion, and then define the subprogram with that TYPE:

```
TYPE FixedLen
 S AS STRING * 20
END TYPE
DIM Array(100) AS FixedLen
SUB DoSomething (Array() AS FixedLen)
 PRINT Array(10).S
END SUB
```

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■ **ROBERT L. HUMMEL**

PC TUTOR

Creating reverse paragraph indention with WordPerfect's margin release function; using MODE's redirection ability to set up a print-spooling program.

How DOS allocates memory when it loads a program

While attempting to write a memory-resident (TSR) program, I was surprised to discover that interrupt 21h function 31h was not allocating the amount of memory that I was expecting it to allocate. In order to discover what was happening, I execut-ed the following set of instructions:

```
MOV DX,1
MOV AX,3400H
INT 21H
```

CHKDSK reported 508,896 bytes of memory free after executing the program compared with 509,168 bytes free before running the program, a loss of 272 bytes. By changing the number loaded into DX, I produced the results shown in Figure 1. What is happening here? Can you shed some light on this behavior?—*James A. Swarts; Muskegon, Michigan*

There are several pieces to this puzzle, so I'll explain them separately and then add them up at the end.

For every block of memory that DOS treats as a unit, it creates a 16-byte MCB (memory control block). The MCB is also known as an *arena header*. The MCB holds information that indicates what program owns the memory block, how large the memory block is, and whether more memory blocks follow it. So, for example, when you ask DOS to allocate 512 bytes, 512 + 16, or 528, bytes will be removed from available memory.

When any program is loaded, at least two memory allocations are performed by DOS. The second allocation is memory for the program being loaded to run in. The first allocation is for a memory area in which to place a copy of the environment. This memory area is known as the environment block. Unless you take steps to de-allocate the environment block, it remains in memory until the program terminates.

In the case of a memory-resident program, the environment block is made resident as well.

For every program that DOS loads, it creates a memory area known as the PSP (program segment prefix). This 256-byte (100h bytes) area is used by DOS to store program-specific information. This includes the address of the environment block, command tail, file handles, address of the parent process, and more. The first 96 bytes of the PSP are sacred to DOS and must remain in memory. Thus the minimum size for any memory-resident program is 96 bytes of PSP plus 16 bytes for the MCB.

The 272 bytes that are allocated for your program break down as shown in Figure 2. Not until you ask DOS to allocate more than 6 paragraphs (96 bytes) does the amount of memory allocated to your program begin to increase.

DOS Function 31h Memory Allocation

	Bytes of memory used	
DX	Expected	Actual
0	0	272
1	16	272
2	32	272
3	48	272
4	64	272
5	80	272
6	96	272
7	112	288
8	128	304
9	144	320
10	160	336
11	176	352
12	192	368
13	208	384

Figure 1: *In a test program, the number of bytes of memory allocated by interrupt 21h function 31h was different from the result that was expected.*

Memory Usage for Sample Program

Bytes	Purpose
16	MCB for PSP
96	PSP
16	MCB for environment
144	Environment
272	Total

Figure 2: *The 272 bytes allocated to the sample program can be broken down according to purpose, as shown here.*

■ PC TUTOR

How to use a print-spooling program with a printer using MODE's redirection ability

I want to set up a print spooler in expanded memory provided by an Intel Above Board PS/286. The Above Board software setup routine asks whether my printer is parallel or serial, and therein lies my question.

To give a coworker access to my HP LaserJet Series II, the printer has been converted to a serial printer with an adapter card equipped with several RJ11 jacks. Separate wires run from the jacks to a serial port on my machine and on his. My AU-TOEXEC.BAT file has been modified with the following two lines:

```
MODE COM2:9600,N,8,1,P
MODE LPT1:=COM2:
```

How do I answer this question in the Above Board's print-spooler setup routine? Do I have a serial or a parallel printer? What's really going on with the MODE command and my AUTOEXEC file?
—*Faina Riftina; New York, New York*

As far as your computer is concerned, your printer is installed on the first parallel port. This means you can access the printer using the device names LPT1: or PRN:.

The second MODE command installs a part of the MODE program as memory resident to intercept all output to the parallel port and redirect it to the second serial port device, COM2:. The first MODE command sets the communications parameters for COM2: to be compatible with your printer-sharing device.

In order to use the print spooler, install it for a parallel printer connected to LPT1:. Then, make sure that the MODE LPT1:=COM2: command is run before the spooler is installed. Otherwise, MODE will bypass the spooler.

Using *WordPerfect*'s margin release function to create reverse paragraph indention

My keyboard doesn't identify any particular key as being the "margin release" key. But now, having discovered a good use for one, I consider this a problem. How can I set the left margin for my text to column 10 and have the first line of each paragraph start at column 5? I am using *WordPerfect* 4.2.—*B.F. Marlow; Benson, Arizona*

Fortunately, the folks at WordPerfect Corp. planned ahead! The margin release key is Shift-Tab and backs the cursor up one tab stop. To reverse-indent a paragraph, simply press Shift-Tab and then type normally. The second line of the paragraph will start at the normal margins you have set.

Repartitioning a hard disk is a low-level disk operation that doesn't preserve data

I have a 30MB hard disk. When I formatted the disk, I partitioned it in two: one partition of 20MB and the second of 10MB. Now I'd like to change the configuration to a single partition of 30MB.
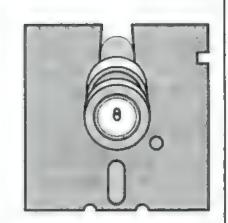
The FDISK description in the DOS manual isn't too clear, and I'm concerned about losing data. Can I delete the D partition and expand the C partition without reformatting and reloading the hard disk?
—*Jack Tucker; Alexandria, Virginia*

If you use FDISK to change the number or size of your hard disk partitions, you will probably lose all your data. The size of a disk partition is used to calculate a number of other disk parameters, including the size and location of the file allocation table (FAT) and root directory. If you change the partition size, this data may be invalid, causing the drive to become unreadable.

Ask the PC Tutor

The PC Tutor solves practical problems, explains points of general interest about using your hardware and software more productively, and answers basic questions about DOS and systems in general. To have your questions answered here, write to PC Tutor, *PC Magazine*, One Park Avenue, New York, NY 10016 or upload them to PC MagNet (to join, see the "By Modem" sidebar in the Productivity section). We're sorry, but we cannot answer questions personally. PC

■ **FRANK J. DERFLER, JR.**

CONNECTIVITY CLINIC

Too many LOCK and UNLOCK statements can slow down your LAN; showing log-in names as part of your DOS prompt; substituting data switches for traditional media-shared LANs.

Remote control of a network workstation is easy

I'm looking for software that will allow me to operate a computer on a LAN over telephone lines. Can you tell me what packages are available?—*Bill Brewster; Turlock, California*

There are several good packages that all compete very closely. My favorite is *Remote²* from DCA/Crosstalk. Watch for a version of this program that operates stations remotely both across telephone lines and across the LAN. Another excellent remote product for LANs is *Close-Up* by Norton-Lambert.

Data switches make fine connections and offer a good alternative

Can you tell me about your experiences with the Newbridge Data PBX systems? I am considering networking 64 PCs, printers, modems, and plotters to one of these systems, and I'd like some feedback. Does daisy chaining the switches for installations of more than 48 devices diminish their performance?—*Tom Hee (via PC MagNet)*

We have never benchmark-tested daisy-chained machines. But considering that the 19.2-kilobit-per-second speed is the biggest bottleneck, I don't think the switching and setup time between data switches will cause a big delay.

However, for an installation of this size I would steer you to the Commix data switches from Itron Corp. Itron is a division of Infotron, so this company has plenty of resources supporting it in the information-systems business. One really neat feature of Commix switches is their ability to use thin Ethernet cabling between the switches. This gives you a long and fast link between 32 port switches for good performance and flexibility.

Many people who spend a lot of time and money installing and maintaining traditional media-shared LANs, such as Ethernet or Token-Ring, would be as satisfied, less harried, and financially ahead if they looked at the data PBX connectivity alternative.

For more information about the Commix data switches, contact Itron Corp., 130 Gaither Dr., #116, Mount Laurel, NJ 08054; (800) 423-8044.

> ■ Many people would be happier if they looked at the data PBX connectivity alternative instead of installing traditional media-shared LANs.

Running PC-based applications on 3270 terminals

Our organization has hundreds of IBM 3270 series terminals connected to mainframe computers. The 3270 terminals and mainframes serve us well, and we have many applications running on them. But some of our people occasionally want to run PC-based applications. We're not going to throw out our existing terminals and replace them with PCs and 3270 terminal emulators—that's not acceptable. Having two keyboards and tubes on some desks is not desirable either. Does anyone make a box that can temporarily connect a 3270 terminal to a PC's CPU and run PC software? Since I've researched this and think the answer is no, then why not?—*Greg Matram; Chicago, Illinois*

It can be done, but I don't know anybody who is doing it. I can think of two or three ways to hook a 3270 terminal to a processor running DOS applications, but they all would take a lot of programming by someone intimately familiar with the 3270 displays and the IBM Coax B interface. There are a lot of details a developer would have to handle to field such a system, but no technical breakthroughs. You could do it using CPU cards such as the Alloy PC-Slave/286 cards or by using an 80386 machine running a multitasking multiuser operating system like *Concurrent DOS 386* or *PC-MOS/386*.

Sure, the 3270 terminals have different aspect ratios and hundreds of other param-

■ CONNECTIVITY CLINIC

eters that are different from any PC's display. But if people happily put up with quirks in 3270 emulation done on a PC, why wouldn't they put up with quirks in PC display emulation done on a 3270?

Why hasn't someone designed the interface? Because they haven't seen the market. Yet, IBM's 3270 series of terminals, along with all of their clones, populate hundreds of thousands of desktops.

Does anybody know how to use them to run *Flight Simulator*?

Productivity Tip

If you are wiring a building, you have two practical choices: twisted-pair telephone wire or the IBM wiring scheme for Token-Ring. Today, twisted-pair works for ARCnet, Ethernet, and many other media-access schemes. Token-Ring wiring is a couple of magnitudes more expensive.

Display log-in names as part of the DOS prompt when sharing workstations

Our office has several users who share various workstations on a LAN running *NetWare* 2.0a. Often they leave their workstations logged on so the next person can quickly access the LAN. Security is not a concern on this network. However, sometimes a user doesn't realize that the previous user changed the log-in name. Then when he sends electronic mail, it is tagged with the previous user's log-in name. The simple way to fix this is to have the user's log-in name appear as part of the DOS prompt. To do this, just include the environment command

```
DOS SET USER="%LOGIN_NAME"
```

in each user's start-up batch program. This sets up the DOS environment variable USER, which contains the current user's log-in name. (Do not include spaces before or after the equal sign and be sure to include the quotes.) This same file should contain the DOS PROMPT command

```
PROMPT %USER% - $p$g
```

This will display the user's log-in name as part of the system prompt along with the current logged drive and directory. Users will know immediately who is logged in at the workstation just by glancing at the prompt. The prompt will look similar to this:

```
SANDY - F:\PUBLIC>
```

—Kevin Fisher; Sicklerville, New Jersey

This hint makes everybody say, "Why didn't I think of that!" For years we've used little yellow stick-ons to identify stations in our test-bed LANs. Now they display the log-in names, thanks to this nifty combination of the environment and prompt commands.

Too many LOCK and UNLOCK commands can slow down your network

I have developed some extensive programs in *DataFlex* and find that it handles the multiuser aspects of database programming pretty well. I usually ran the programs on a Novell network, however. When I implemented them on a network running 3Com's *3+Share*, I saw a serious performance degradation. After some testing, I found that having many LOCK and

■ Database programmers should always be aware that the speed and performance of a database application is degraded every time a file is locked.

UNLOCK statements really slows down the network.

DataFlex puts a lock on both data and index files before it makes an update. When your database grows and contains many related files, it becomes obvious that the LOCK and UNLOCK statements can create a lot of unnecessary overhead. Some informal tests showed that an UNLOCK statement issued across more than two dozen related files in *NetWare* was significantly faster than the same command operating under *3+Share* system software. I thought your readers would like to know.*—Jan J. Ehrhardt; Amsterdam, Netherlands*

These comments serve as good reminders for a couple of things: first, database programmers should always be aware how the efficiency of a database application is degraded every time a file is locked. If the DBMS locks files automatically, you should find out when it locks them and keep things *unlocked* as much as possible.

Secondly, we can see why 3Com is switching to a true multiuser operating system (OS/2) as the basis of its new LAN operating system, *3+Open*. We reviewed *3+Open LAN Manager* in the Connectivity section of the February 28, 1989, issue.

Productivity Tip

If you need to network dissimilar mini, mainframe, and micro computers, you should know about the Transmission Control Protocol and Internet Protocol (TCP/IP). Many companies market communications software packages using these protocols, and they will work for you—today!

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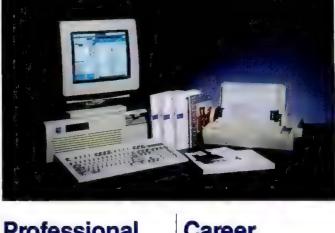
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3. The Seller's notice must contain a stamped self-addressed card or envelope with which you can indicate your preference. If you don't respond to this notice, the Seller may assume you agree to the delay, but must either ship or cancel your order within 30 days after the original shipping date promised or required. A prompt refund must be made when an order is cancelled.

4. Even if you've consented to an indefinite delay, you retain the right to cancel the order at any time before the item has been shipped.

5. If you choose to cancel an order, that has been paid for by check or money order, the Seller must mail you a refund within seven business days. If you cancel an order for which you paid by credit card, the seller must credit your account within one billing cycle following receipt of your request. Store credits or vouchers in place of a refund are not acceptable.

6. In the event that the item you ordered is unavailable, the Seller may not send you substitute merchandise without your express consent.

TIPS WHEN ORDERING
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State precisely what merchandise you want, specifying details such as model, make, size, component parts, etc.;
Confirm the price and expected delivery date as stated in the ad;
Indicate whether you will accept a substitute product if the item you ordered is unavailable, and, if not, that your payment should be returned;
Don't send cash, you will have no record of payment if a problem arises; and,
Keep a copy of your order and all other correspondence with the Seller. Your records should include the company's name, address and phone number; a description of the item ordered; your cancelled check or a copy of the money order; record of the date you mailed the order, or the time and date of your conversation, and the name of the person you talk with; and any sales slips and shipping receipts.
Ask about servicing and refund/return policies and with whom you should correspond if there is a problem.

IF YOU HAVE PROBLEMS

1. If you have not received your order as promised or if the item is defective, immediately notify the Seller in writing referring to your order by description, price, date, as well as by account number and order number, if available. Make sure you keep a copy of the letter.

2. If you complain by telephone, send a follow-up letter to confirm what was said.

3. If you think the merchandise is defective, reread your product instructions and your warranty carefully to be sure you don't expect features or performance the product isn't designed to give. Then contact the Seller for instructions. Don't return it to the Seller until you have been instructed to do so.

4. When returning merchandise make sure you keep the shipper's receipt or packing slip; your right to be reimbursed for postal cost is determined by store policy.

5. If you have completely discussed your problem with the Seller and are still not satisfied, write to the consumer complaint agency in the Seller's state. If you paid for the merchandise by credit card, you may have rights to withhold payment under a Federal law called the Fair Credit Billing Act.

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COMING UP

SUPER VGA MULTISCANNING MONITORS In our cover story, we rate 19 12- to 14-inch multiscanning monitors capable of Super VGA (800 by 600) resolution. With 50 percent more pixels than standard VGA (640 by 480), Super VGA costs a little more. But its higher resolution makes it a good choice to display today's growing number of applications that have a graphical user interface. The beauty of these multiscanning monitors goes beyond raw pixels and colors, however, because they're flexible. They reach back to older standards, and they let you outgrow today's prevailing VGA standard without investing in a new video adapter.

HIGH-END PROJECT MANAGERS *PC Magazine* reviews the top-of-the-line performers, software powerful enough to satisfy today's demanding corporate users. We examine *Open Plan*, *Plantrac*, *Primavera Project Planner*, *Qwiknet Professional*, *SSP's Promis*, and *ViewPoint*, products that can do everything from graphing project flow and calculating resource utilization to extensive cost reporting. These sophisticated packages can handle the largest projects; find out whether they're worth their high price.

DESKTOP PUBLISHING TRAINING TAPES PC users can produce presentation-quality output for desktop publishing thanks largely to *PageMaker* 3.0 and *Ventura Publisher*, but these complex packages are difficult to learn. Good software trainers are hard to find and expensive to hire. Are recorded training videos a viable alternative? We evaluate nine different tutorials on videocassette.

ASYNC COMMUNICATIONS OVER PC-BASED LANS Communications software expert Les Freed explains why and when sharing modem connections on a LAN makes good sense. We cover both hardware and software approaches to asynchronous communications over a network in six detailed reviews. *PC Magazine* looks at entries from eight different companies, including IBM, Novell, and Omnitel.

Super Huey II Brings Thrill of Flight, Heat Of Battle to Your Desk

BY JEFF PROSISE

Have you ever wanted to pilot a combat helicopter? *Super Huey II*, a helicopter flight simulation program from COSMI, lets you take a seat at the controls of a UH2X Super Huey, one of the most formidable helicopter gunships ever devised. For $24.95, you own the skies, patrolling with armaments you select from a shopping list that includes air-to-air and air-to-ground laser-guided missiles, 2.75-inch rockets, 9-mm machine guns, and 40-mm grenades.

Don't become complacent, though. Enemy aircraft, ships, submarines, and ground-based weapons lurk around every corner, ready to shoot you down and claim the skies as their own unless you react quickly and effectively.

Super Huey II offers a reasonably accurate simulation of what flying a helicopter is really like. Your screen shows the view out the front windshield, with the instrument panel below and weapons indicators overhead. You control the engine RPMs and balance the pitch of the main rotor against the pitch of the aircraft itself to control the rate of vertical ascent or descent and the speed of forward movement.

To turn the aircraft, you change the pitch of the tail rotor to over- or undercompensate for the torque produced by the main rotor. All of this can be done from the keyboard, but you'll get more out of the game with a joystick. The joystick is linked to the helicopter and tail-rotor pitch controls, making it relatively simple to guide the Huey toward its target.

On-board systems include an advanced Target Recognition Computer (TRC), which automatically steers laser-guided weapons to their destinations; a CO_2 tank for putting out fires; air and ground radar screens that permit you to keep tabs on objects around you; and an enemy-missile warning light that is activated when another laser-guidance system locks onto your helicopter.

A navigational radio and odometer allow you to tune to an incoming VOR signal and establish compass vectors and distance to or from the source.

Super Huey II comes with

Super Huey II *supports only CGA resolution, which gives the graphics a blocky look, especially when compared with games that support EGA or VGA resolution. As the Huey II pilot, you have an out-the-window view similar to those found in other flight simulators.*

six built-in combat-mission scenarios that test your flying and navigational skills in a variety of situations. The first mission, "Renegade," pits you against a helicopter similar to your own that is systematically destroying friendly ground bases. Unless you can confront the enemy and defeat him in an air battle, your own helicopter is forfeited when the last base is destroyed.

"Gulf of Terror" places you on a reconnaissance mission in the Mediterranean. The sea is littered with ships and submarines belonging to both sides. Prudence suggests that you not fire until you've sorted the friends from the foes, but you often don't know who the foes

are until you see an anti-aircraft missile streaking toward you!

"P.O.W. Rescue" challenges you to land inside a hostile P.O.W. camp and evacuate the friendly forces held prisoner there. You must fly in low to avoid detection and act fast, for enemy reinforcements are on the way.

In "Oil Blaze," you're in a race against time to extinguish a fire set by terrorists on an oil drilling station, and you must also deal with land-based attack vehicles trying to thwart you. Take too much time and the oil station blows up, taking you

right along with it.

"Bermuda Triangle" pits you against unknown natural and unnatural forces while on a weather reconnaissance mission off the coast of Florida. And "Antarctic Rescue" tests your navigational skills in icy Antarctic weather as you attempt to locate and rescue a lost team of researchers.

No matter which mission you choose, you'll find it difficult to best your opponent until you've become dexterous with the helicopter controls. A hit from enemy fire may result in the destruction of your Huey or any of a number of equipment malfunctions—oil line breaks, coolant leaks, transmission

trouble, damage to pitch controls, linkages, rotors, and more that manifest themselves in strange ways and force you to return to base for repairs.

Even finding the base may be difficult if electrical problems affect your navigation system. If you are lucky enough to make your way back, you can take the opportunity to rearm while you're there—and ready yourself for another go at the opposing forces.

Sounds great, but a lot of game/simulation packages that look great on paper are disappointing on-screen. Is *Super Huey II* fun? Yes. It takes only a short while to become a proficient pilot, and once you learn to fly the beast, there's the added challenge of airborne combat and reconnaissance. There's a tremendously satisfying feeling when you launch a TOW missile at a bouncing surface ship, watch it streak toward the target, and see the ship disappear in a fiery explosion. *Super Huey II* isn't short on graphics and shows the whole drama. Graphics animation was acceptably smooth on an 8-MHz 286-based machine.

This package's Commodore 64 heritage (it was originally written for the 64, then translated for IBM PCs) suggests that it is more a game than a true simulation, but that's not to its discredit. More annoying is the fact that, even on systems with EGA support, *Super Huey II* is limited to blocky CGA graphics, albeit in 16 colors.

If you're in the market for exciting air-combat software that blends elements of realism with the thrills of blasting enemy attackers from the sky, check out *Super Huey II*. At $24.95, you've got everything to gain and little to lose.

List Price: *Super Huey II*, $24.95. **Requires:** 256K RAM, CGA or EGA graphics, DOS 2.1 or later. Not copy protected. COSMI, 31 N. Figueroa St., Wilmington, CA 90744; (213) 835-9687.
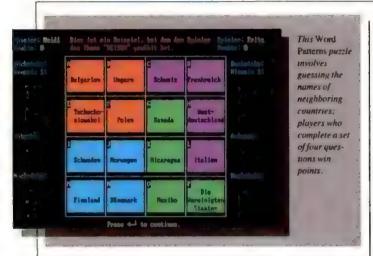
This Word Patterns *puzzle involves guessing the names of neighboring countries; players who complete a set of four questions win points.*

Word Patterns—German Conceals Education In an Absorbing Game

BY STEPHANIE K. LOSEE

OK, I admit it. I hate German. I like French and Italian, those romance languages that roll elegantly off the tongue. Somehow, making choking sounds in the back of my throat never struck me as particularly romantic or elegant.

After testing Gessler Educational Software's *Word Patterns—German*, I still hate German, but I like this program. It's an easy-to-use teacher's tool that can be modified to supplement any course of study.

Operating on the assumption that students are more likely to play games than fill in exercises, *Word Patterns*, which costs $49.95, transforms a vocabulary drill into a two-player struggle for points.

The players confront a 16-square playing board; they win points by finding four related vocabulary words arranged in a colored pattern. Upon choosing a square, the player is given a clue.

He can request a second clue, at which time he must guess or lose his turn. The fewer clues he needs, the more points he scores, until all the words are found and a winner is declared.
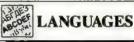
The program has the facility to recognize close guesses; if the student chooses the wrong article or forgets to capitalize a noun, the program allows him a second guess without identifying the error. In modifying the game, teachers have the freedom to provide more than one correct answer.

The package comes with four sample games, in which I became so immersed that my nearly forgotten German vocabulary began to return. I played against myself by taking both players' turns; it's just as much fun as competing with another person.

Word Patterns comes in English, French, Italian, and Spanish versions, in addition to German, and it's so versatile that instructors can use it at any level for a wide variety of teaching needs. It may even charm those reluctant language students whom teachers dream of reaching.

List Price: *Word Patterns—German*, $49.95. **Requires:** 256K RAM, CGA graphics, DOS 2.0 or later. Not copy protected. Gessler Educational Software Inc., 55 W. 13th St., New York, NY 10011-7958; (212) 627-0099.

Ticket to Spain Brings Exotic Locales To Your PC

BY JENNIFER ZAINO

If you can't afford a real ticket to Spain but want to brush up on your Spanish, you could part with just $39.95 for a copy of Blue Lion Software's *Ticket to Spain*.

The program not only gives you a chance to practice simple language skills but also tests your knowledge of Spanish history, art, and geography. Users who are tentative about their Spanish comprehension can play the game in English and still get the benefit of a lesson in the country's culture, traditions, and social customs.

Ticket to Spain takes you on a tour of Spain in search of a family heirloom, which becomes your reward if you complete the eight tasks assigned to you. While reading through the brief manual will make some of the tasks immediately apparent, others are couched in more-mysterious terms. Your quest may take you to famous points of interest in eight cities, including to the Alhambra, the Prado, and an 8th-century mosque in Cordoba.

You get points for every multiple-choice question you answer correctly at each stop; the questions are drawn from a database of approximately 2,000 facts. You have two chances to get each answer, and the game doesn't tell you the right answer if you miss.

Your accumulated points can be exchanged for cash. Keeping a pocketful of dinero is crucial, because travel to and from cities is not free, and some of the tasks require that you indulge in Spanish delicacies or pick up a few *recuerdos* (souvenirs).

I must confess to some disappointment upon completing my adventure, as the heirloom for which I had been so vigorously searching was never identified. And the CGA graphics somewhat dulled an otherwise colorful trip.

A suntanned body and an album full of photographs are not the legacies of this *Ticket to Spain*, but anyone who hopes to make the real trip someday will appreciate the chance this program offers to sharpen simple language skills and get acquainted with the country.

List Price: *Ticket to Spain*, $39.95. **Requires:** 128K RAM, DOS 2.0 or later. Copy protected. Blue Lion Software Corp., 90 Sherman St., Cambridge, MA 02140; (617) 876-2500.

In Ticket to Spain, *some of the eight tasks you are assigned at the beginning of the game involve trying out Spanish cuisine. Make sure you have accumulated enough points to pay for your meal, though.*

AFTER HOURS

Italian-Language Software Is Effective Despite Flaws

BY LUISA SIMONE

English, as much as Americans may hate to admit it, is not yet the lingua franca of the civilized world. There are still lots of places where the local people just don't understand English, no matter how slowly and loudly it is spoken by an exasperated tourist. And there is no underestimating the joy of speaking the local language while traveling abroad.

Italian Grammar Computerized-I

If the time has come for you to brush up on your high school Italian, look no further than Lingo Fun's $29.95 *Italian Grammar Computerized-I*.

Lingo Fun produces language-review products in Italian, Spanish, German, French, and even Latin. *Italian Grammar* proves that the company knows what it's doing. The program wisely mimics both the structure and content of an introductory textbook.

Sadly, like a textbook, there are no gimmicks and no really good graphics. But this basic course, which focuses on only the simple present and past perfect tenses, is all you need to make yourself understood in Italian. One floppy disk contains the pronouns, possessives, indirect objects, and verbs that are essential for simple communication.

This product is designed for those who already have a basic understanding of the language; even the program's comments on your answers are in Italian. Intended as a review only, *Italian Grammar* never defines vocabulary words, although you can access explanations of grammatical usage from just about anywhere in the program.

Italian Grammar Computerized-I uses a fill-in-the-blank teaching method, which I applaud as more effective than multiple-choice questions. When (and if) you type in a wrong answer, you are prompted to try again. I also appreciated the coding system that clues the user in on specific types of mistakes. An *x* under a letter, for instance, indicates that the letter is a duplicate. After three wrong attempts, the program kicks in with the right answer.

Cloze Encounters in Italian

The benefits of Lingo Fun's *Italian Grammar Computerized-I* are unfortunately not duplicated by a companion program, *Cloze Encounters in Italian*. The cloze teaching method (hence the name of the product) tests reading comprehension by asking the student to supply words that have been deleted from a text.

It's the same fill-in-the-blank instruction technique that works so well in *Italian Grammar*. But here artificial limitations make the method illogical. You can only choose to blank-out arbitrarily selected portions of the narrative, such as every vowel, every consonant, or every second, third, fourth, or fifth word. The random patterns that result force the student into lessons that have more to do with memorizing text than with learning a foreign language.

In addition, although the product contains definitions for new vocabulary words, I found the words to be less than useful. The menu choices look promising, with encounters in restaurants, trains, and hotels all covered. In the section on train travel, however, I could not find the words or phrases related to buying a train ticket.

Cloze Encounters also contains an editor that allows teachers to add new text passages and make other modifications. This feature alone could make the product a worthwhile investment for a school.

Italian Grammar and *Cloze*

Cloze Encounters in Italian *includes an editor that allows teachers to modify the menus and introduce new texts into the program.*

Encounters share a common look and feel, which in this case means CGA resolution and some sloppy programming. I found that, when the programs score a lesson, the grade is often miscalculated. And the programs sometimes freeze up if you enter a keystroke when none was expected.

I could only recommend *Cloze Encounters in Italian* to teachers willing to spend some time improving the on-disk curriculum. But students of all ages can profit from time spent with *Italian Grammar Computerized-I*. Of course, clever students will take the money they save on the low price and spend it on a trip to Rome.

List Price: *Italian Grammar Computerized-I*, $29.95 for single users; $49.95 for schools (backup disk included).
Requires: 256K RAM, CGA graphics, DOS 2.0 or later. Copy protected.

CIRCLE **414** ON READER SERVICE CARD

List Price: *Cloze Encounters in Italian*, $29.95 for single users; $49.95 for schools (backup disk included).
Requires: 256K RAM, CGA graphics, DOS 2.0 or later. Copy protected. Lingo Fun Inc., P.O. Box 486, Westerville, OH 43081; (614) 882-8258.

CIRCLE **415** ON READER SERVICE CARD

Italian Grammar Computerized-I will give you hints on how to correct a wrong answer. The underline indicates that a letter should change. The feedback—in Italian— prompts the user to try "one more time."

LANGUAGES

French Scrabble and Vocabulary Software: Fun Leads to Fluency

BY P. J. SPRINGER

The patient PC is well suited to helping students grapple with the intricacies of foreign languages. The same rational machine that inculcates the dry logic of physics also helps teach that most romantic of romance languages: French. Gessler Educational Software offers *Micro Scrabble* to aid advanced French students in building their vocabularies. Gessler's *Bataille de Mots* takes a more structured, traditional approach to teaching French grammar and vocabulary.

Micro Scrabble

Just when you thought it was safe to claim proficiency in French, along comes *Micro Scrabble* to put your Left Bank lingo through its paces and back again. The program, which costs $39.95, allows up to three people to match their skills against the computer or up to four to play one another.

A graphic of the standard Scrabble board, complete with bonus squares to tempt the competitive word hound, is the software's only screen. To play, you type a word, then use the cursor keys to position your word on the board. The computer tallies the score and asks if you want to try another word. If the PC doesn't recognize the word you've chosen, it politely asks if you're sure. If you hit O (for *oui*), your word is accepted.

This honor system seems only fair, since the software's dictionary comes up with some gems of its own, including English words—*jerk* and *spat*, for example. And what, pray tell, is *amui*? It's enough to break a Francophile's heart.

During its turn, the computer's "thoughts" are displayed, so you can watch it try various word placements. Even at the slowest setting, however, the ideas fly by too quickly to be followed.

Perhaps the strongest feature of *Micro Scrabble* is its flexibility. In addition to the initial setup options, you can use the number keys to affect play in a variety of ways. Among other things, you can force the computer to take its turn immediately, see how many tiles of each letter are still available, or, my favorite, get help.

Aside from its occasional use of English words, *Micro Scrabble*'s biggest shortcoming is its rather undramatic screen resolution and colors. Even if these problems were fixed, however, *Micro Scrabble* still

wouldn't be a game for French-language beginners. The very premise of Scrabble—in any language—is recognizing words within a jumble of letters, a talent that requires virtual fluency. Serious parlez-vous-ers only.

Bataille de Mots

On the other side of the Seine, Gessler Educational Software offers *Bataille de Mots*. The $49.95 program is a vocabulary-building tool designed for French students with 1 to 2 years' experience, but it can be reconfigured for additional skill levels.

From the main menu you pick one of six topics, from food to travel and transportation, and a part of speech on which to focus. The next menu offers a choice of a thorough vocabulary review, a quick vocabulary review, a multiple-choice quiz, a fill-in-the-blank exercise, or a game.

Bataille de Mots offers 25 useful words in each category of each topic. There is intelligent use of important grammatical constructions and verb tenses throughout. The various exercises are straightforward, and each question offers a translation at the end. After a set of questions, the program tallies

correct and missed responses, shows which words caused difficulty, and offers to let the user try these again.

Bataille's creators also lend a nice balance to the text by emphasizing female roles in unexpected areas, such as sports.

By far the most entertaining exercise is a shooting gallery–style game. The "gun" is a bereted Frenchman who must be lined up with the French synonym for an English word that flashes on the screen.

Bataille de Mots is intended as a teaching tool, and this is its best use. Instructors can edit topics, create new ones, and generate tests based on program material. This enables a teacher to alter the program according to students' skill levels.

List Price: *Micro Scrabble*, $39.95.

Requires: 256K RAM, DOS 2.0 or later. Copy protected.

List Price: *Bataille de Mots*, $49.95.

Requires: 256K RAM, DOS 2.0 or later. Not copy protected. Gessler Educational Software Inc., 55 W. 13th St., New York, NY 10011-7958; (212) 627-0099.

Micro Scrabble presents the popular word game in a Continental mode. Up to four players can compete with each other, three can play against the PC.

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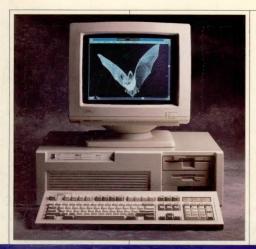
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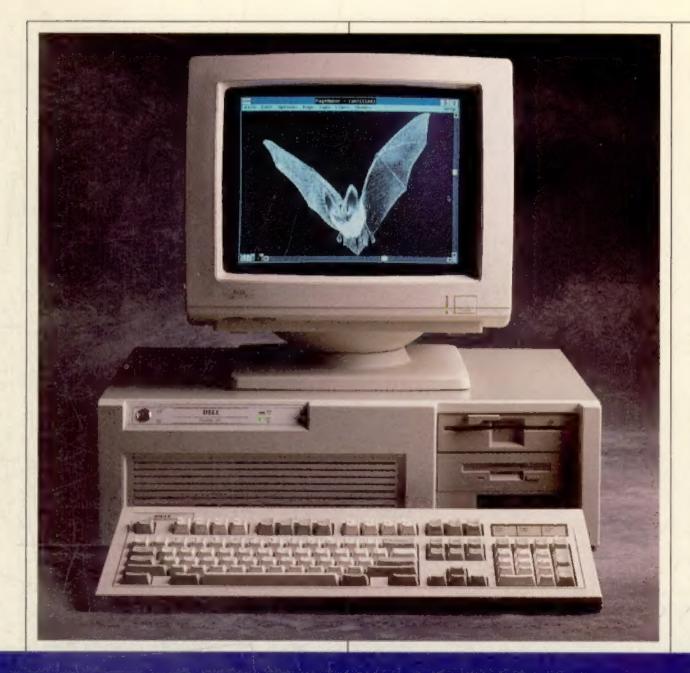
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